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Firms' Productive Performance and the Investment Climate in Developing Economies

An Application to MENA Manufacturing

Tidiane Kinda
Patrick Plane
Marie-Ange Véganzonès-Varoudakis

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Abstract

Drawing on the World Bank Investment Climate Assessment surveys, this paper investigates the relationship between firm-level technical efficiency and the investment climate for 22 developing economies and eight manufacturing industries. The authors first propose three measures of firms' productive performance: labor productivity, total factor productivity, and technical efficiency. They show that, on average, enterprises in the Middle East and North Africa have performed poorly compared with other countries in the sample. The exception is Morocco, whose various measures of firm-level productivity rank close to the ones of the most productive economies. The analysis also reveals that the competitiveness of countries in the region has been handicapped by high unit labor cost, compared with main competitors like China and India. The empirical results show then? that the investment climate matters for firms' productive performance. This is true (depending on the industry) for the quality of various infrastructure, the experience and education level of the labor force, the cost of and access to financing, as well as different dimensions of the government-business relation. The analysis reveals that some industries, more exposed to international competition, are more sensitive to investment climate deficiencies. For some industries, this is also true for small and medium domestic enterprises that do not have the possibility to influence their investment climate or choose their location. These findings bear clear policy implications by showing that increasing firms' size and improving the investment climate (in particular of small and medium firms and industries more exposed to international competition) could constitute a powerful means of industrial development and competitiveness, in the Middle East and North Africa region in particular.

This paper—a product of the Middle East and North Africa Region—is part of a larger effort in the region to use enterprise surveys to identify constraints on productivity and growth in developing countries. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. For information, contact jdethier@worldbank.org.

Firms' Productive Performance and the Investment Climate in Developing Economies: An Application to MENA Manufacturing

Tidiane KINDA

Patrick PLANE

Marie-Ange VÉGANZONÈS-VAROUDAKIS

CNRS-CERDI, Université d'Auvergne
65, Boulevard François Mitterrand
63000 Clermont-Ferrand, FRANCE

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Corresponding author: Marie Ange Véganzonès (veganzones@aol.com)

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1- Introduction

Recent developments of the economic literature have put the investment climate at the center of economic performance. It is now well documented that the investment climate can significantly affect investment, productivity, and growth[1]. A growing literature suggests, in particular, that successful market-based economies need good governance institutions[2]. Governance exerts a strong influence on the investment climate. On the empirical side, several studies have related economic performances to different measures of governance[3]. The role of security of property rights is one of the best documented and supported by the data[4]. Some authors have also tested the role of corruption[5] and, to a lesser extend, regulation[6] and bureaucratic quality[7]. More recently, the literature has evaluated firm performance and its determinants using enterprise surveys data[8]. This approach, still quite new, aims at strengthening the institutional literature by providing microeconomic foundation.

Investment climate is defined by the World Bank as the policy, institutional and regulatory environment in which firms operate (see World Bank, 2005). Key factors affecting the investment climate are corruption, taxation, regulatory framework, quality of bureaucracy, legal environment, availability and quality of infrastructures, availability and cost of finance, factor markets (labor and capital), technological and innovation support. A good investment climate reduces the cost of doing business and leads to higher and more certain returns on investment. The forward- looking nature of investment underlines the importance of a stable and secure environment. A poor investment climate is also seen as constituting barriers to entry, exit and competitions. The World Bank (2004) reports as well that a better investment climate improves bureaucratic performances and predictability, and contributes to the effective delivery of public goods that are necessary for productive business.

In MENA, various studies point out the deficiencies of the investment climate. This is the case of the World Bank (2004) for governance, as well as of country studies based on enterprises surveys, in particular the World Bank Investment Climate Assessments (*ICA*) of *Egypt* (2005 and 2006), *Morocco* (2001 and 2005), and *Algeria* (2002). *Doing Business* (World Bank, 2009) also places MENA low on business climate indicators[9]. These deficiencies have been reported as contributing to the poor economic accomplishment of the region[10]. Although MENA countries are, in average, defined as middle income-economies, growth and investment performances in particular have been disappointing for more than three decades[11]. Attractiveness to FDI has also been weak, as well as competitiveness and exports of manufacturing[12]. MENA competitiveness has constantly been affected by poor exchange rate policies and insufficient economic reforms. But other factors, such as the investment climate, can also explain the low productivity and the high production costs at the firm level.

The World Bank Investment Climate (*ICA*) surveys collect data on inputs and outputs, as well as on various aspects of the investment climate at the firm level. *ICA* surveys produce both subjective evaluations of obstacles, as well as other more objective information with direct link to cost and productivity on the themes of infrastructure, human capital, technology, governance, and financial constraints. These standardized surveys of large samples of firms from different sectors permit comparative measures of firms' productive performance. They also provide information to estimate the contribution of investment climate to these performances. In a context of increasing pressure of globalization, *ICA* surveys can be seen as an instrument for identifying key obstacles to firms' productivity and competitiveness. They can be used as a support to policy reforms for an increased economic growth.

Drawing on the World Bank firm-surveys, this paper analyzes the relationship between investment climate and firm-level productivity for a large number of developing countries (22 among which 5 MENA economies) and eight manufacturing industries. We first propose different measures of firms' productive performances, such as Labor Productivity (*LP*), Total Factor Productivity (*TFP*), and Technical Efficiency (*TE*) using a production frontier approach. These indicators are compared to each others as well as across countries, in order to position MENA manufacturing amongst a wide range of firms from other regions. We reveal that enterprises in MENA perform in average poorly, compared to other countries of the sample. The exception is *Morocco*, whose various measures of firms' productive performance always rank close to the one of the most productive firms in the sample. An originality of our approach has also been to generate a few composite indicators of investment climate using Principal Component Analysis (*PCA*), which summarizes well the key dimensions of the investment climate. This has allowed as well tackling the problem of multicolinearity when explaining firm productive performances with a wide range of correlated *IC* variables. We define four dimensions of the investment climate: the Quality of Infrastructure (*Infra*), the Business-Government Relations (*Gov*), the Human Capacity (*H*), and the Financing Constraints (*Fin*). We use, as well, city or region-sector averages to reduce the endogeneity problem underlying the investment climate (*IC*) variables. The analysis finally shows that investment climate matters for firms' productive performances. This has been done by estimating an efficiency function explaining firm-level productivity for each of our 8 manufacturing industries.

The paper is organized as follows. The second section introduces different concepts of firm-level productivity and discusses the advantages and limits of the different measures. Section three presents the investment climate (*ICA*) surveys and summarizes their main limitations. The fourth section presents and compares across countries our different estimations of firms' productive performances by industry. The fifth section introduces the investment climate indicators used in the empirical analysis, and calculates our four broad *IC* indicators. The sixth section highlights MENA investment climate deficiencies. In the seventh section, we examine whether the various dimensions of the investment climate constraints firms productive performances. The last section concludes

2- Measures of Firm-Level Productivity: Methodological Aspects

Our first challenge has been to measure firms' productive performance in a relevant way. We propose different approaches and measures. We first consider a non parametric model of productivity, which consists in calculating productive performances without estimating a production function. Non parametric measure of productivity constitutes a simple and already meaningful way of assessing for example Productivity of Labor (*LP*) and Total Factor Productivity (*TFP*). Another way has been to calculate firms' productive performance from a parametric production frontier. This more sophisticated methodology allows to identify the most efficient firms of the sample and to compare MENA firms' performances to them.

2.1- Non Parametric Measures of Productivity and Unit Labor Cost

Productivity can easily be calculated as the ratio of an output to a specific factor of production (defined as Productivity of Labor when the factor is labor), or to all relevant factors of production (called Total Factor Productivity, *TFP*). In this paper, we only refer to productivity levels because of the limited time dimension for the production factors (two to three years at the best) and no time dimension for the *IC* variables. Our analysis thus focuses on comparisons of firm-level productivity among enterprises, industries and countries[13].

In the empirical analysis, we first discuss Labor Productivity (*LP*), which gives a first idea of the productive performance of the firms. Productivity of Labor has the advantage not to be affected by the error in measuring the capital stock. However, the technology is partially described and calculation of productivity suffers from the omission of this variable. Productivity of Labor can be complemented by calculations of Unit Labor Cost, defined as the ratio of firm average wage to firm's labor productivity. This indicator allows comparisons of the cost of labor across countries in competition in the world markets. Firms' productivity of labor can also be biased by the choice of the exchange rate when converting production into US$. This is less the case of *TFP* because the same rate applies to the output (*Y*) at the numerator, and to the intermediate consumption (*ICons*) and capital stock (*K*) in the denominator.

Non parametric Total Factor Productivity (*TFP*) constitutes another simple (and also more complete) way to evaluate firms' productive performances. Under the hypothesis of constant returns to scale, (i.e., perfect competition for goods but also for factors that are remunerated at their marginal productivity) weights of Intermediate Consumptions (*ICons*) and of Labor (Wages, *W*) are estimated as the ratio of the cost of these factors to the Total Cost of Production including profit (*Y*). The contribution of Capital (*K*) is then calculated as the complement to one. The advantage of this approach, based on the Solow residuals, is that it does not require the inputs to be exogenous or the inputs elasticity to be constant. The disadvantage is that two hypotheses have to hold: (a) constant returns to scale; and (b) competitive input markets. Another limitation can be seen in the fact that productivity, being calculated as the residual of the production function, is considered as a random variable, which makes it difficult to justify that some exogenous factors can explain productive differences. The equation is as follows:

$$TFP_i = \frac{Y_i}{L_i^{\omega_{1i}} IC_i^{\omega_{2i}} K_i^{(1-\omega_{1i}-\omega_{2i})}} \qquad (1)$$

$$\omega_{1i} = \frac{W_i}{Y_i}, \ \omega_{2i} = \frac{IC_i}{Y_i} \qquad (2)$$

2.2- Parametric Production Functions and Production Frontiers

In the parametric approach, *TFP* is calculated as the residual of an estimated production function, thus relaxing the hypotheses of constant returns to scale (but not automatically of productivity as a random variable). Various hypotheses can be made regarding the technology of production. The Cobb Douglas and the Translogarithmic production functions are the most commonly used. Although both present good mathematic properties, the elasticities of the production to the inputs are easy to read and to interpret with the Cobb Douglass technology.

In the case of a parametric production function, production is derived from the optimization problem of the firms, which in perfect competition maximize current and expected profits by equating production prices to their marginal costs. This hypothesis does not permit any waste of resources or organizational weaknesses. The production frontier approach, however, allows for non optimal behaviors of the firms. Enterprises can be positioned in regard to the most efficient firms that define an empirical production frontier. Firm-level Technical Efficiency (*TE*) can then be defined as the firms' productivity gap (or efficiency gap) to the "*best practice*", the empirical practice of the firms which are located on the production frontier.

The deterministic parametric production frontier approach can be implemented in a rather simple way, under the restrictive assumption that the production does not suffer from the classical disturbances. The higher positive residual of the regression is used as a correction term, to defining the most efficient observation. The other observations are positioned comparatively to this most efficient observation. Correction is applied to the intercept of the regression for all the observations, except this one. The residual of estimation (u_i) is a random variable, uncorrelated and independent of the right-hand side variables. u_i can be transformed as an indicator of efficiency of value 1 (or 100% when expressed in percent) when $u_i = 0$. For the firms of the sample for which the residual is not zero, u_i measures the potential performance gain that these enterprises can achieve. The deterministic parametric production frontier is specified as follows:

$$y_i = f(x_i, \beta) - u_i \ , \quad u_i \geq 0 \qquad (3)$$

With

- *Y:* Production
- *X:* Production factors
- *B :* Parameters of the equation
- u_i : Technical Efficiency (*TE*)
- *i*: Firm index

In the stochastic model, the likelihood estimation method is typically applied to estimate a "composite" error term which is split into two uncorrelated elements. The first term *(v)*, which is a random variable, represents the external shocks to the firm. These shocks, independent and identically distributed, follow a normal distribution, with zero average and σ^2 standard deviation. The second term represents the Technical Efficiency *(-u*). We will suppose that *u* follows a truncated normal distribution. In this specification, firms' productive performances are not assimilated to a random variable and can then be explained by exogenous factors. The interest of this approach can also be seen in the fact that *TEs* have a relative form and can be compared across countries and regions. Although there is a wide range of choices as regard the statistical distribution of the efficiency term (*u*), the ranking of firms according to the efficiency term is generally not sensible to the choice of the specific distribution (Coelli, Prasada Rao and Battese, 1998). Equation is as follows:

$$y_i = f(x_i, \beta) - u_i + v_i \qquad (4)$$

With

- *Y:* Production
- *X:* Production factors

- *B* : Parameters of the equation
- *v* : External shocks
- *u* : Technical Efficiency (*TE*)
- *i*: Firm index

2.3- Explaining Technical Efficiency

A complementary approach, when having calculated Technical Efficiency (*TE*), is to explain the reasons for firms' diverse performances. Firms' inefficiency can be explained by "exogenous" factors which affect either the technology of production, or the firm's ability to transform inputs into outputs. In the literature, these factors have been estimated in two different ways. A simple method consists in estimating the stochastic production frontier, and in regressing the residual of the estimation (the Technical Efficiency, *TE*) on a vector of explanatory factors (z). This method is called the "Two Steps" procedure. Different estimation procedures can be used. The simplest way is to run an OLS regression. Another possibility is to apply a Tobit model, in order to address the question of the distribution of the efficiency. The "Two Steps" procedure presents, however, some shortcoming in separating the Technical Efficiency (*TE*) from the production frontier. When some production frontier inputs (x) are explained by factors affecting efficiency, there is an issue of simultaneity[14]. Because the Technical Efficiency term (*TE*) is correlated with the production frontier inputs (x), the likelihood estimation of the stochastic production frontier is biased, due to the omission of important explanatory variables.

In fact, a relatively new branch of the literature proposes to estimate the production frontier and the factors explaining inefficiency at the same time. This is the "One Step" procedure. In this case, the parameters of the equation (here *β* and *δ)* are simultaneously estimated by the likelihood estimation method. The stochastic version of the model can be written as follows:

$$y_i = f(x_i, z_i, \beta, \delta) - u_i + v_i \qquad (5)$$

With
- *Y*: Production
- *X*: Production factors
- *Z*: Factors explaining Technical Efficiency
- *v* : External shocks
- *u* : Technical Efficiency
- *β* / *δ:* Parameters of the equation
- *i*: Firm index

3- The ICA Firm Surveys: Data Limitations

The World Bank Investment Climate (*ICA*) surveys collect data on inputs and outputs, as well as on a large variety of quantitative and qualitative (perception-based) indicators of the investment climate. In building the database, we have tried to incorporate as much information as possible. We have integrated in our sample 23 countries which participate in the five main regions of the developing world: Sub-Saharan Africa (*AFR*), East Asia (*EAS*), South Asia (*SAS*), Latin America and the Caribbean (*LAC*), Middle East and North Africa (*MENA*, see list of countries in *Annex* 1)[15]. In this sample, MENA is represented by 5 countries: *Algeria* (2002), *Saudi Arabia* (2005), *Lebanon* (2006), *Morocco* (2000, 2004) and

Egypt (2004, 2006)[16]. *Syria* (2003) and *Oman* (2003), which were initially part of the sample, had to be removed because of a very low rate of answer to the questionnaire. By broadening the initial sample to a large number of countries from different regions, we have intended to compare MENA performances to the ones of emerging economies which appears as major competitors in the world market: *China* and *India* in particular.

To estimate firm-level productivity, we initially considered a population of almost 20,000 firms, coming from 13 manufacturing industries. This initial sample had to be reduced due to various limitations. Calculation of productive performances requires information on at least 5 variables: (1) production, (2) intermediate consumption, (3) labor, (4) wages, and (5) capital stock. For several enterprises, part of this information appeared difficult to get. For others, answers showed flagrant inconsistencies. Enterprises were eliminated in particular when the calculation of productive performances revealed to be questionable or not in line with the income per capita in the country[17]. Some industries as well had to be merged, due to insufficient observations. In fine, 12 414 enterprises (3073 for the MENA region) regrouped in eight industries were retained when estimating the production frontiers (see *Annex 2*)[18].

As for inputs and output, investment climate variables are subject to measuring errors. In the surveys, some firms did not report the full range of investment climate measures. Other firms reported numbers that were not credible. This is also due to the fact that most of investment climate factors are qualitative variables of perception, thus allowing answers to vary depending on the firms, the regions or the countries. Our choice has been to keep as many firms as possible, providing sufficient information on a wide range of investment climate variables. Once outliers and incomplete observations were removed, 5002 observations were left, among which 1483 for the MENA region, what represent 34% of MENA initial population and 30% of the total number of enterprises with *IC* variables (see *Annex 2*).[19].

Another question relates to the endogeneity of the *IC* variables, due to the qualitative nature of investment climate factors. This is particularly true for perception variables (such as obstacles to operation) for which firms are asked to position their answer on a given scale[20]. The perception of the scale might be different across firms, industries, regions and countries. Besides, when answering the questions on their investment climate, firms may be influenced by the perception they have of their own productivity and may attribute their inefficiencies to external factors. High-performing firms, as well, may be proactive in reducing their investment climate constraints, for example by working with the authorities to limit inspections or secure more reliable power supply. They also can choose a location with better infrastructure and production conditions, what relates to the endogeneity of implantation.

In the empirical part, we assume these endogeneneities and use appropriate estimation techniques to evaluate the impact of the investment climate on the firms' productive performances. We measure in particular investment climate variables as city or region-sector averages of firm-level observations[21]. This also helps to mitigate the effects of missing observations for some firms. Actually, if we take each investment climate indicator at the firm level, we end up with a smaller sample of observations in which all indicators are available. Furthermore, to address the issue of endogeneity of firms' implantation, we restrict the sample to the enterprises that are less likely to choose their location. We define a category of domestically owned firms employing less than 150 workers by excluding from the sample the foreign, as well as large domestically owned firms,

Exchange rate constitutes another source of uncertainty which may lead to over or under evaluate firm's productive performances. This rate is used to convert production and production factors into US dollars. Several exchange rates can be chosen to calculate and compare firm-level productivity across countries. In this study, we considered the current market rate in US dollars which has the interest to be the rate that firms use for their economic calculations[22].

4- Estimating Firm-Level Productivity: MENA Performance Gap

In this section, we present our three measures of firm-level productivity: Productivity of Labor (*LP*), Total Factor Productivity (*TFP*) and Technical Efficiency (*TE*). The data have been pooled across the 22 countries of our sample[23]. Firm-level productive performances are calculated for each of the eight industries. Differences and similarities across countries have been analyzed. A pattern of generally low productive performances is observed in the MENA region, with however some countries showing better results.

4.1- Firm-level Labor Productivity and the Unit Labor Cost

Firm-level Productivity of Labor (*LP*) is estimated as the ratio of the firms' Value Added (*Y*) to the Number of Permanent Workers. The Value Added is calculated as the difference between Total Sales ($S_{i,j}$) and Total Purchase of Raw Material -- excluding fuel ($IC_{i,j}$)[24]. We make the hypothesis that firms are price takers, thus purchasing raw material at world price, what looks like an acceptable assumption for the manufacturing industry which is exposed to international competition. In this case, prices in dollar of production and intermediary consumptions are comparable across countries. Equation is as follows:

$$LP_{i,j} = Y_{i,j} / L_{i,j} \qquad (6)$$

With
- $Y_{i,j}$: Value Added.
- $L_{i,j}$: Number of Permanent Workers
- i / j: Enterprise and country index respectively.

Tables 2 and 3 display (by country and by industry) the averages Labor Productivity (*LP*) and Unit Labor Cost. Unit Labor Cost has been computed by dividing the "Total Wages" (*W*) by the "Value Added" (*Y*). For each country, average productivity (Unit Labor Cost) is expressed in percent of the level of the country with the most performing firms (or the country with the lowest Unit Labor Cost). Calculations in level are given in Tables 3.1 and 3.2 in *Annex* 3[25]. The analysis reveals a relatively stable ranking of countries. *South African* and *Brazilian* firms perform -- in average and in most industries -- the best. This result is consistent with the relatively high incomes in the two countries (2710 and 2780 dollars per capita respectively, see World Bank, 2005). *Morocco (2004)'s* firms also participate in the best performances of the sample, especially in *Metal & Machinery Products, Chemical & Pharmaceutical Products, Leather* and *Agro-Processing.*

As far as other MENA countries are concerned, the ranking remains also rather stable. *Egyptian* and *Lebanese's* firms are systematically among the least performing in all industries (although *Morocco* and *Egypt* have the same GDP per capita, at around 1300 US dollars in 2003). In *Algeria*, firm-level Productivity of Labor (*LP*) ranks an intermediate position, close to *India* in *Agro-Processing* and *Chemical & Pharmaceutical Products,* but behind in *Textile* and *Metal & Machinery Products* (firms' performances are always lower than in China). *Moroccan's* firms thus remain the most performing ones in MENA, with levels of Productivity of Labor (*LP*) far ahead from the two Asiatic giants, and close to the most productive firms/countries of the sample[26].

This relative efficiency of some MENA countries, however, is not sufficient to understand the capacity of these countries to promote industrial and export activities. Remuneration of labor is an important factor which should be in line with productivity. By combining information on Productivity of Labor (*LP*) and the cost of labor, the relative Unit Labor Cost gives an idea of the competitiveness. Table 3 presents some information on the subject. It is worth noticing that the Unit Labor Cost in MENA is one of the highest of our sample of countries. This is particularly true in *Algeria* and *Egypt* – countries where firm-level Productivity of Labor (*LP*) is among the lowest – but also in *Morocco* and to some extend *Lebanon*. In MENA, the Unit Labor Cost is of the same magnitude than in the most performing countries of the sample, sometimes even higher (see the case of *Brazil*), and by far much superior than in the majority of Asian economies (*India*, *China*, *Sri Lanka*, *Bangladesh* and *Thailand*). In *China* and *India*, salaries (around 100 US dollars per month for unskilled workers) are far lower than in *Morocco* (more than the double). In the labor intensive sectors of *Textile* and *Garments*, cost of labor is 2 to 2 and a half time higher in *Egypt* and *Morocco* than in *India*. This situation should be seriously addressed, if MENA wants to compete in the world market. If not, MENA will continue to suffer from the faster technological innovation in Asia, where wages remain low.

Table 1. Firm-Level Labor Productivity

(Country average, in % of the country with the most productive firms)

Country*	**Textile**	**Leather**	**Garment**	**Agro Processing**	**Metal & Machinery Products**	**Chemic & Pharm Products**	**Wood & Furniture**	**Non Metal & Plastic Materials**
South Africa (2003)	52		**100**	**100**	94	97	87	**100**
Brazil (2003)	**100**	**100**	50	50	66	**100**	38	
***Morocco** (2004)*	*54*	*80*	*54*	*79*	***100***	*91*		*66*
***Morocco** (2000)*	*56*	*94*	*55*	*85*	*48*	*63*		*57*
***Saudi Arabia** (2005)*				*77*	*92*		***100***	
Ecuador (2003)	58	91	80	48	50	54	42	66
El Salvador (2003)	71	59	55	35	28	51		46
China (2002)	52	69	45		31			
Thailand (2004)	62		62	45	40		31	43
Guatemala (2003)	43		64	31	26	36	33	48
India (2002)	35	66	53	21	22	17		
Honduras (2003)	56		50	29	23	39	21	26
India (2000)	39		48		28	24		
Pakistan (2002)	40	35	49	22		17		
Tanzania (2003)				35			20	
Philippines (2003)	32		32	14				
***Algeria** (2002)*	*27*			*21*	*19*	*19*		*31*
Bangladesh (2002)	18	53	16	9		11		
Nicaragua 2003	13	38	26	17	13	17	16	21
Sri Lanka (2004)	13		27	9	17			28
Zambia (2002)	16			13	24	18		
Ethiopia (2002)	11	20	20	10			10	
***Egypt** (2006)*	*14*	*15*	*14*	*12*	*16*	*11*	*10*	*13*
***Egypt** (2004)*	*15*	*20*	*14*	*9*	*11*	*11*	*11*	*11*
***Lebanon** (2006)*	*11*		*17*	*8*			*7*	

Note : * Ranking of countries goes from the ones with the most productive firms to the ones with the least productive firms. *Source*. Authors' calculations

Table 2. Firm-Level Unit Labor Cost
(Country average, % of the country with the highest unit cost)

Country*	Textile	Leather	Garment	Agro Processing	Metal & Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
El Salvador (2003)	52	**100**	**100**	85	**100**	63		87
Nicaragua (2003)	**100**	72	80	87	88	**100**	92	79
Guatemala (2003)	64		83	**100**	79	87	89	74
Algeria *(2002)*	*73*			*89*	*89*	*96*		***100***
Philippines 2003)	66		92	83				
South Africa (2003)	86		97	74	80	88	69	64
Morocco *2004)*	*81*	*79*	*91*	*75*	*75*	*76*		*60*
Honduras (2003)	36		78	88	76	63	96	86
Egypt *(2004)*	*51*	*66*	*77*	*77*	*55*	*86*	***100***	*57*
Egypt *(2006)*	*60*	*86*	*76*	*71*	*46*	*80*	*92*	*51*
Saudi Arabia *(2005)*				*89*	*59*		*55*	
Lebanon *(2006)*	*55*		*53*	*61*			*92*	
Morocco *(2000)*	*62*	*62*	*84*	*60*	*58*	*66*		*62*
Zambia (2002)	46			75	48	88		
Brazil (2003)	48	54	72	68	56	49	65	
Sri Lanka (2004)	86		64	71	39			32
Bangladesh (2002)	49	34	60	69		55		
Ethiopia (2002)	71	25	45	56			55	
Ecuador (2003)	48	59	52	50	42	32	62	53
Thailand (2004)	42		56	49	35		52	34
China (2002)	39	41	54		38			
Pakistan (2002)	31	41	33	47		51		
India (2000)	36		38		37	46		
India (2002)	32	27	35	42	35	44		
Tanzania (2003)				33			31	

Note : * Ranking of countries goes from the ones with the most expensive labor to the ones with the least expensive one.
Source. Authors' calculations

4.2-Firm-Level Total Factor Productivity

In this section, firm-level Total Factor Productivity (*TFP*) is calculated from a non parametric production function. Production factors include Labor (*L*) and Capital (*K*). Same hypotheses and definitions as before apply to input and output variables. Equation is as follows:

$$PTF_{i,j} = \text{Log}(Y_{i,j}) - \alpha \text{ Log}(K_{i,j}) - \beta \text{ Log}(L_{i,j}) \qquad (7)$$

With

- $Y_{i,j}$: Value Added
- $L_{i,j}$: Number of Permanent Workers
- $K_{i,j}$: Gross Value of Property, Plant and Equipment

- β: Ratio of Total Wages (*W*) to Total Production Cost (*Y*).
- $\alpha = 1 - \beta$
- i / j: Enterprise and country index, respectively

Table 3. Firm-Level Total Factor Productivity

(Country average, in % of country with the most productive firms)

Country*	Textile	Leather	Garment	Agro Processing	Metal & Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
South Africa(2003)	88		**100**	**100**	91	82	**100**	**100**
Brazil (2003)	**100**	**100**	87	**100**	**100**	**100**	91	
***Morocco** (2000)*	*80*	*81*	*79*	*79*	*70*	*90*		*71*
Thailand (2004)	70		90	75	73		78	82
***Morocco** (2004)*	*73*	*64*	*77*	*77*	*70*	*79*		*80*
***Saudi Arabia**(2005)*				*70*	*68*		*81*	
Ecuador (2003)	69	74	76	73	75	72	78	64
El Salvador (2003)	76	70	66	64	61	69		76
Philippines (2003)	64		77	65				
***Algeria** (2002)*	*65*			*44*	*59*	*66*		*76*
Honduras (2003)	61		72	55	57	84	50	54
Guatemala (2003)	65		67	54	62	56	54	73
India (2000)	67		63		58	58		
China (2002)	59	58	56		45			
Zambia (2002)	58			52	55	52		
Pakistan (2002)	55	58	56	54		48		
India (2002)	59	61	49	54	51	50		
Tanzania (2003)				55			53	
Sri Lanka (2004)	41		51	61	51			56
Bangladesh (2002)	51	46	57	50		44		
Nicaragua (2003)	49	51	45	47	42	50	44	52
Ethiopia (2002)	51	34	46	49			36	
***Lebanon** (2006)*	*35*		*39*	*40*			*37*	
***Egypt** (2004)*	*41*	*36*	*35*	*39*	*34*	*33*	*36*	*43*
***Egypt** (2006)*	*37*	*30*	*33*	*41*	*34*	*34*	*31*	*38*

Note: * Ranking of countries goes from the ones with the most productive firms to the ones with the least productive firms.
Source: Authors' calculations

Table 3 presents the firm-level relative *TFP* by industry, under the reasonable assumption that a sector-based technology leads to a more homogeneous production function. As for Productivity of Labor, results are presented in percent of the average *TFP* of the most performing country (detailed calculations are given in *Annex* 4). Conclusions are quite similar than for Productivity of Labor.

A first conclusion concerns the ranking of the most performing countries. As previously, *South Africa* and *Brazil* present, in most industries, the most productive firms. These countries are again followed by *Morocco*, which firms' productive performances are quite good in most industries. When compared to *Brazil*, *Moroccan* firms show a *TFP* gap of 10 to 30 percent depending on the sector, what is less than the revenue gap between the two countries (47 %, and 38.5% in *PPP* respectively). As far as other MENA countries are concerned, ranking is also quite similar than for Productivity of Labor (*LP*). As previously, *Egypt* and *Lebanon* rank at the bottom of the sample (with a limited number of enterprises for the latter country), while

Algeria stays in an intermediate position. *TFP* calculations thus confirm the productivity gap assessed through Productivity of Labor[27].

4.3- Firm-Level Technical Efficiency

Firm-level Technical Efficiency (*TE*) is based on the likelihood estimation procedure. As seen in section 2.2., this method allows splitting the error term into two independents factors: the error term *(v)*, which follows a normal distribution, and the Technical Efficiency *(u)*, which obeys a truncated normal distribution. The technology of production explains the Value Added (*Y*) by the Capital (*K*) and the Labor (*L*). Same hypotheses and definitions as before apply to input and output variables. Equation is as follows:

$$\text{Log}(Y_{i,j}) = \alpha \text{ Log}(K_{i,j}) + \beta \text{ Log}(L_{i,j}) + dum_{i,} - u_{i,j} + v_{i,j} \qquad (8)$$

With:

- $Y_{i,j}$: Value Added
- $L_{i,j}$: Number of Permanent Workers
- $K_{i,j}$: Gross Value of Property, Plant and Equipment
- dum_j: Country-dummy variables
- α, β: parameters of the equation
- $v_{i,j}$: Error term
- $u_{i,j}$: Technical Efficiency (*TE*).
- i / j: Enterprise and country index respectively.

Production frontiers have been estimated by industry. As mentioned before, this leads to more homogeneous production frontiers and makes it easier to attribute the residual to differences in efficiency. Differences in coefficients of capital and labor have justified this choice; against an alternative assumption consisting in estimating the same production frontier for all sectors, with specific sector-based dummies (see Table 4).

Table 4: Estimations of the Stochastic Production Frontiers

	Dependant Variable: Value Added							
Independent Variables	**Textile**	**Garment**	**Leather**	**Agro Processing**	**Metal & Machinery Products**	**Chemic & Pharm Products**	**Non Metal & Plastic Materials**	**Wood & Furniture**
Log (labor)	0.659 (30.53)***	0.811 (42.69)***	0.826 (20.20)***	0.695 (31.22)***	0.877 (33.21)***	0.673 (22.21)***	0.886 (22.35)***	0.941 (29.18)***
Log (capital)	0.354 (24.87)***	0.260 (20.96)***	0.277 (11.00)***	0.404 (28.62)***	0.289 (18.52)***	0.444 (22.89)***	0.281 (13.54)***	0.228 (12.79)***
Intercept	2.007 (18.94)***	1.350 (9.22)***	1.419 (9.81)***	1.863 (13.99)***	1.716 (15.61)***	2.065 (15.39)***	1.419 (9.73)***	1.644 (11.51)***
$\sigma^2 u$	0.33	0.22	0.80	0.73	1.12	0.39	1.30	0.79
σ^2	0.99	0.92	1.40	1.47	1.76	1.13	1.86	1.19
$\sigma^2 u / \sigma^2$	0.33*** (6.17)	0.24*** (3.00)	0.57*** (6.33)	0.50*** (8.17)	0.64*** (12.80)	0.35*** (5.00)	0.70*** (10.00)	0.66*** (13.20)
Observations	2011	2800	634	2190	1622	1274	907	1033

Note: * Significance level 10 %; ** 5 %; *** 1 %. Z statistics are into brackets. Regressions include country-dummy variables.
Source: Authors' calculations

Table 4 presents the estimation results of the production frontiers. In most industries, the sum of the coefficients relative to labor and capital inputs is close to one. It is a little bit higher for some sectors than can be suspected to face investment indivisibilities. In comparison with other sectors, *Textile* is probably the most exposed to the competition and the production technology does not reject this hypothesis. For all industries, the coefficients are strongly statistically significant at the 99% level of confidence.

Table 5. Firm-Level Technical Efficiency

(Country average, in % of country with the most productive firms)

Country*	Textile	Leather	Garment	Agro Processing	Metal& Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
South-Africa 2003	85		**100**	**100**	**100**	89	**100**	**100**
Brazil 2003	**100**	**100**	87	80	98	**100**	62	
***Morocco** 2004*	*58*	*70*	*81*	*70*	***100***	*72*		*92*
***Saudi-Arabia** 2005*				*72*	*76*		*81*	
***Morocco** 2000*	67	76	80	71	68	83		70
Thailand 2004	64		93	67	65		47	66
Ecuador 2003	57	86	61	61	63	60	57	63
El Salvador 2003	40	62	65	58	55	63		66
Guatemala 2003	51		77	45	57	45	48	67
Honduras 2003	58		66	42	48	60	37	48
India 2000	47		66		45	34		
India 2002	42	56	66	41	46	32		
Pakistan 2002	43	49	61	40		31		
China 2002	46	45	51		35			
Philippines 2003	36		53	39				
***Algeria** 2002*	*33*			*35*	*39*	*38*		*54*
Nicaragua 2003	22	55	41	34	38	30	31	49
Tanzania 2003				43			32	
Zambia 2002	29			30	41	21		
Sri Lanka 2004	17		37	26	33			39
Bangladesh 2002	24	41	32	28		19		
Ethiopia 2002	20	30	36	22			23	
***Egypt** 2004*	*21*	*30*	*21*	*17*	*22*	*17*	*19*	*32*
***Egypt** 2006*	*17*	*15*	*22*	*22*	*25*	*14*	*19*	*24*
***Lebanon** 2006*	*21*		*23*	*16*			*13*	

Note : * Ranking of countries goes from the ones with the most productive firms to the ones with the least productive firms. *Source*. Authors' calculations

Table 4 also specifies the percentage of the residual explained by the Technical Efficiency (*TE*). It can be seen that, in all industries, the efficiency term accounts for a significant part of the total residuals and is statistically significant at 99%. This result justifies the production frontier approach, against the production function approach. In this model, *TE* explains from 24% of the error term in *Garment* to 70% in *Non Metallic & Plastic Materials*. *TEs* are distributed in an interval of 0 to 1 (1 is the value of the sector's most efficient firms; see *Annex* 5). In Table 5, *TEs* are in percent of the average *TE* of the most performing country. In average, our results for Technical Efficiency (*TE*) are close to the ones obtained for the non parametric *TFP* under the hypotheses of constant returns to scale. The ranking of countries, in particular, remains unchanged. As previously, *Brazilian* and *South African's* firms show the best performances in all industries, along with *Moroccan's* firms. Only in *Garment* and *Leather*, *Moroccan's* firms are surpassed by *Thailand* and *Ecuador* respectively. Ranking of MENA countries, as well, is unchanged.

4.5- Firm-Level Productivity Measures: A High Correlation

Annex 6 displays, by industry, the Spearman coefficients of correlation of our three measures of firm-level productivity. All coefficients are highly significant and show a high degree of correlation between the different measures. This is the case in all industries, but more specifically in *Wood & Furniture, Non Metallic & Plastic Materials,* and *Metal & Machinery Products* (after *Agro-Processing, Chemicals & Pharmaceutical Products, Leather,* and *Textile).* This result justifies our choice of Technical Efficiency (*TE*) as a measure of firm-level productivity to be explained by the countries/ industries investment climate (see section 6). It will also make our findings more general, because they can be extrapolated to the different indicators of firm-level performance.

5- Assessing the Investment Climate of the Manufacturing Industries

Another step in our analysis has been to differentiate and categorize the different dimensions of the investment climate. The World Bank Investment Climate (*ICA*) surveys provide information on a large number of investment climate (*IC*) variables -- in addition to general information on firms' status, productivity, sales and supplies. These *IC* variables are classified into 6 broad categories: (***a***) *Infrastructures and Services*, (***b***) *Finance*, (***c***) *Business-Government Relations*, (***d***) *Conflict Resolution/Legal Environment*, (***e***) *Crime*, (***f***) *Capacity, Innovation, Learning*, (***g***) *Labor Relations*.

In the surveys, there are multiple indicators that cover a similar theme. Within the same theme, the correlation between indicators can be high. One solution consists to limit the number of indicators. This can however lead to a biased estimation, due to the omission of important explanatory variables. Also, it is not sure that the *IC* variables retained are good proxy of investment climate. A solution to overcome these problems consists in generating a few composite indicators. Because we intend to determine which investment climate variables are more detrimental to firm performances, we tried to take into consideration an as large as possible set of *IC* variables which are not typically used in the literature. Since these variables are likely to be correlated, we applied Principal Component Analysis (*PCA*) to produce a limited number of composite indicators[28].

Based on the *ICA* surveys, we defined the investment climate by four broad categories: "Quality of Infrastructure" (*Infra*), "Business-Government Relations" (*Gov*), "Human Capacity" (*H*), and "Financing Constraints" (*Fin*). As seen in section 3, our choice of indicators has been restricted by important data limitations. This is also why we have not been able to cover all aspects initially developed in the surveys. Indicators have been selected on the bases of being available for the countries of our sample, as well as capturing the different key dimensions of the investment climate. Besides, we have tried to complete as much as possible the qualitative (perception-based) *IC* indicators by quantitative information, in order to get a better picture of the investment climate in each industry/country.

The Quality of Infrastructure indicator (*Infra*) has been defined by six variables: Obstacle for the operation of the enterprise[29] caused by deficiencies in (***a***) Telecommunications, (***b***) Electricity, and (***c***) Transport; (***d***) Does the Firm Own or Share a Generator, (***e***) if yes, which Percentage of Electricity Comes from that Source; Does the Enterprise have access to (***f***) E-mail or (***g***) Internet in its Interaction with Clients and Suppliers. Infrastructure deficiencies constitute an important constraint to private sector development in developing countries (see

World Bank, 1994). In the literature, deficiency in infrastructure is seen as a burden for enterprises operations and investment. Infrastructures are considered, as well, as a complementary factor to other production inputs. In particular, infrastructure stimulates private productivity by raising profitability of investment[30]. Furthermore, infrastructure increases firms' productive performances by generating externalities across firms, industries and regions[31].

The "Business-Government Relations" indicator (*Gov*) includes three to six variables (depending on the industries): Obstacle for the operation of the enterprise caused by (***a***) Tax Rate, (***b***) Tax Administration, (***c***) Customs and Trade Regulations, (***d***) Labor Regulation, (***e***) Business Licensing and Operating Permits, and (***f***) Corruption. This indicator illustrates the capacity of the government to provide an investment-friendly environment and reliable conditions to the private sector. Corruption is seen as having an adverse effect on firms' productive performances. This fact is well documented and often described as one of the major constraints facing enterprises in the developing world (see the World Bank, 2005). Corruption increases costs, as well as uncertainties about the timing and effects of the application of government regulations (see Tanzi and Davooli, 1997). Taxation and regulations have also a first order implication on firms' costs and productivity. Although government regulations and taxation are reasonable and warranted in order to protect the general public and to generate revenues to finance the delivery of public services and infrastructures, over-regulation and over-taxation deter productive performances by raising business start-up and firms' operating costs.

The "Human Capacity" indicator (*H*) is represented by three to four variables: Obstacle for the operation of the enterprise caused by deficient (***a***) Skill and Education of Available Workers; (***b***) Education level[32] and (***c***) Years of Experience of the Top Manager; (***d***) Training of the Firm's Employees. Human capital constitutes an essential factor of firms' productive performances. Human capital stimulates capital formation by raising firms' profitability. Human capital is also at the origin of positive externalities[33]. Because skilled workers are better in dealing with changes, a skilled work force is essential for firms to adopt new and more productive technologies (see Acemoglu and Shimer, 1999). Besides, new technologies generally require significant organizational changes, which are better handled by a skilled workforce (see Bresnahan, Brynjolfsson and Hitt, 2002). Human capital gives also the opportunity to the enterprises to expand or enter new markets.

The "Financing Constraints" indicator (*Fin*) consists of three variables: Obstacle for the operation of the enterprise caused by: (***a***) Cost, and (***b***) Access to Financing; (***c***) Access to an Overdraft Facility or a Line of Credit. Access to (and cost of) financing represent major determinant(s) of firms' productive performances. Access to financing allows firms to finance more investment projects, what leads to an increased productivity through higher capitalistic intensity and technical progress embodied in the new equipments. Besides, financial development has a positive effect on productivity as a result of better selection of investment projects and higher technological specialization through diversification of risk. A developed financial system creates more profitable investment opportunities by mobilizing and allocating resources to the projects that will generate the most surplus (see Levine, 1997, for a synthesis).

All four aggregated indicators have been generated at the branch level, thus defining in each country the specific investment climate of each industry. This has implied to produce 32 aggregated indicators (four indicators multiplied by eight industries) by applying Principal Component Analysis (*PCA*) to the initial indicators[34]. The analysis usually treats investment climate as exogenous determinant of firms' performance. As seen in section 3.3, however, this is not always the case. In order to address this issue, we have measured *IC* variables as city or region-sector averages of firm-level observations. This has helped, as well, to increase the number of observations by integrating in the sample firms for which information is insufficient. This has been done for "Infrastructure" and "Business-Government Relations". For "Human Capacity" and "Financing Constraints", however, the initial indicators having been interpreted as specific to each firm, information has been kept at the firm level (except for the variable "Skill and Education of Available Workers") . The initial *IC* indicators are presented in *Annex 7*, along with some information on firms' characteristics. The figures highlight well, in average, MENA deficient investment climate, as well as the specificities of the industrial sector in the region.

6- Investment Climate: How Do MENA Economies Perform?

Chart 1 in *Annex* 8 confirms what we know of MENA investment climate. When MENA is compared to the non MENA countries of the sample, the region always ranks below. This is true for all four dimensions of the investment climate. MENA investment climate is in average of poorer quality than in East Asia (*EAP)*, Africa (*AF)*, Latin America (*LA)* and South Asia (*SA*) -- except for the quality of infrastructures which appear as less a constraint than in this last region (see Chart 2 in *Annex* 8). These findings, which are in line with the literature (see World Bank, 2005), can clearly be related to the disappointing firm productive performances assessed previously.

A more detailed analysis reveals, however, differences across countries and indicators. It is again *Morocco* who seems to suffer the least from *IC* limitations, except from financing constraints. Quality of infrastructures, business-government relations and human capacity inadequacies do not appear very much higher than in *South Africa*, the country where firms' productive performances are in average the highest (see Chart 3 in *Annex* 8). On the opposite, firms in *Lebanon* appear to face strong inadequacies in infrastructures and business-government relations. *Egypt* and *Saudi Arabia* are in an intermediate position, with however relatively high deficiencies in the business-government relation, in particular in *Egypt*. These results are also in line with our findings on firms' productive performances (see section 3).

As far as the different dimensions of the *IC* are concerned, a disaggregated approach shows which specific aspects are of more concern in the region. Limitations in all three components of the financing constraint demonstrate MENA deficit and cost of funding. This is also true for most dimensions of human capacity and of government-business relations (in particular the tax rate and administration, the labor regulations, and the licenses and operating permits, see Table 1 in *Annex* 7). MENA deficient financial system, as well as firms difficulties (SMEs in particular) in finding affordable credit, are important aspects often emphasized in the literature, at the same time as the limitations of various dimensions of the business environment and the lack of training and expertise of the labor force[35]. As far as the quality of infrastructures is concerned, our results are more mitigated than usually highlighted in the literature. If MENA firms seems, in average, to face more constraints in electricity delivery (more enterprises rely on a generator), as well as in internet connection, quality of telecommunications and transports does not appear as very strong obstacles to operation (see Table 1 in *Annex* 7). Although this finding looks somehow in contradiction with the conclusions of several studies, differences may be due to our small number of MENA countries, as well as to the presence of Morocco whose quality of infrastructures is not perceived as a strong limitation[36]. These results are confirmed at the country level, with

Morocco experiencing more deficiencies in the various dimensions of the financing environment, *Egypt* and *Saudi Arabia* in different aspects of the government-business relation and *Lebanon* in all components of the quality of infrastructure and government-business relation (see Charts 4 to 9 in *Annex* 8).

Finally, MENA enterprises are characterized by a smaller size and a lower export orientation than in the rest of the sample (see Table 1 in *Annex* 7). *Morocco*, however, show a high export rate, in particular in the *Textile*, *Leather* and *Garment* industries, as well as *Lebanon*, in *Wood and Furniture*. *Morocco* presents as well an above average foreign participation in the capital of the firms (see Chart 10 in *Annex* 8).

7- Is the Investment Climate Explaining Firm-Level Productivity?

In this section, we estimate several variants of a model of Technical Efficiency (*TE*) which explains the production frontier and the factors contributing to the efficiency at the same time (following the one step procedure, see section 2). Investment climate is first defined by a few indicators of infrastructures, human capacity, government-business relation and financing constraints. To overcome multicolinearity, we introduce then our four *IC* composite indicators: *Infra*, *H*, *Fin* and *Gov*. After having controlled for endogeneity of *IC* variables, we finally address the question of endogeneity of implantation, by restricting our sample to the domestic firms of less than 150 workers. We show that our results are unambiguous and robust to the different specifications and samples of firms.

7.1- Common Model with Individual Indicators of Investment Climate

Our empirical model considers a same representation for all industries. This model is estimated at the branch level, thus allowing the coefficients to vary across branches. We explain firms' production frontiers and Technical Efficiencies (*TEs*) at the same time by regressing the logarithm of the production factors (capital and labor), as well as various plants characteristics and investment climate variables, on the logarithm of the firms' value added. At this first stage of investigation, we have used initial *IC* variables before aggregation. The model is as follows:

$$\ln(y_{i,j}) = c_i + \acute{\alpha}_1 \ln(l_{i,j}) + \acute{\alpha}_2 \ln(k_{i,j}) + \beta\ Size_{i,j} + \gamma\ Foreign_{i,j} + \delta\ Export_{i,j}$$

$$+ \varepsilon_1\ RegElect_{i,j} + \varepsilon_2\ RegWeb_{i,j} + \lambda_1\ Cred_{i,j} + \lambda_2\ AccessF_{i,j} + \eta_1\ EduM_{i,j} + \eta_2\ ExpM_{i,j}$$

$$+ \eta_3\ Training_{i,j} + \mu_1 \times RegLregul_{i,j} + \mu_2 \times RegCorrup_{i,j} + c + v_{i,j}: \qquad (9)$$

With:

$y_{i,j}$	Value Added[37]
$l_{i,j}$:	Number of Permanent Workers
$k_{i,j}$:	Gross Value of Property, Plant and Equipment
$Size_{i,j}$:	Size of the firm
$Foreign_{i,j}$:	Foreign capital *(% of firm's capital)*
$Export_{i,j}$:	Export *(% of firm's sales)*
$RegElect_{i,j}$:	Electricity delivery (*obstacle for the enterprise, regional average*)
$RegWeb_{i,j}$:	Utilization of Internet (*regional average*)
$Cred_{i,j}$:	Overdraft facility or credit line

$AccessF_{i,j}$:	Access to financing (*obstacle for the enterprise, regional average*)
$EduM_{i,j}$:	Level of education of the top manager (*number of years*)
$ExpM_{i,j}$:	Experience of the top manager (*number of years*)
$Training_{i,j}$:	Training of workers
$RegLreg_{i,j}$:	Labor regulation (obstacle for the enterprise, regional average)
$RegCorrup_{i,j}$:	Corruption (obstacle for the enterprise, regional average)
$c_{i:}$	Country-Dummy variables
c:	Intercept
$v_{i,j}$:	Error terms
i / j:	Enterprise and country index respectively

The choice of the *IC* variables has been based on their availability for as many firms/ industries/ countries as possible, as well as on capturing the different key dimensions of the investment climate. Our variables cover properly the four axes of the investment climate defined in the previous section. To address the problem linked to the endogeneity of the *IC* variables when estimating the *TE* frontier models, we have considered the city region-sector averages of Electricity delivery (*RegElect*), Access to Internet (*RegWeb*), Labor regulation (*RegLreg*), and Corruption (*RegCorrup*). The number of explanatory variables, however, has been limited by the multicolinearity between several *IC* variables when estimating the *TE* frontier models.

Other individual variables have consisted in: the percentage of sales exported by the firms (*Export*), the percentage of foreign ownership of firms' capital ($Foreign_{i,j}$), as well as the firm size ($Size_j$). Export is a factor of productivity by confronting firms to international competition. Foreign ownership, as well, increases productivity if foreign investors bring new technologies and management techniques. As for the size, we intend to test the hypotheses of scales economies and increasing returns to scale in big enterprises[38]. It is worth noting that the expected sign for these variables is negative, due to the fact that the one step procedure explains firm-level inefficiency. The same precautions must be taken when interpreting the sign of the coefficients of the other variables. Country-dummy variables have also been introduced when estimating the production frontiers. There are good reasons to think that production may vary across countries for motives other than production factors. The country dummies can pick up the effect of countries specific factors, such as endowment in natural resources, national-level institutions, macro or political instability, trade policy, etc... Country-dummy variables are intentionally not included in the second part of the equation, when explaining Technical Efficiencies (*TEs*), since they could reduce the impact of some *IC* variables.

Equation (*9*) has been estimated on unbalanced panels, going from 380 observations (in *Leather*) to 1601 observations (in *Garment*) depending on the industry. A Cobb-Douglass production function has been chosen to estimate the production frontiers. We have also maintained our previous assumption as regard the specification of the technology, as well as of the Technical Efficiency (*TE*). Although the sample size modifies when incorporating the regressors explaining the firm distance to the frontier, the coefficients of the technology are marginally (but downward) affected. These modifications display the potential impact of the interactions and the limitation that we would face when estimating the Technical Efficiency (*TE*) determinants through the two stage method, as previously discussed[39]. Sector-based estimates are presented in Table 6.

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Table 6. Estimation Results: Common Model with Individual *IC* Variables
(Dependant Variable: Value Added)

Independent Variables	Textile	Leather	Garment	Agro Industry	Metal& Machinery Products	Chemic & Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
ln(l)	0.657 *(16.14)****	0.789 *(28.82)****	0.735 *(7.12)****	0.560 *(13.32)****	0.871 *(21.75)****	0.540 *(11.09)****	0.883 *(18.78)****	0.860 *(10.18)****
ln(k)	0.321 *(14.61)****	0.255 *(14.93)****	0.242 *(7.18)****	0.395 *(24.64)****	0.268 *(13.21)****	0.444 *(20.01)****	0.235 *(11.28)****	0.249 *(8.81)****
Intercept	0.720 *(1.55)*	1.597 *(4.21)****	1.993 *(2.25)***	3.780 *(5.79)****	1.654 *(4.88)****	2.985 *(6.08)****	0.157 *(0.55)*	1.251 *(2.22)***
Size	0.018 *(0.11)*	-0.105 *(0.21)*	-0.092 *(0.48)*	-0.195 *(2.57)***	0.600 *(0.96)*	-0.193 *(1.92)**	-0.316 *(1.29)*	0.014 *(0.07)*
Foreign	-0.242 *(0.53)*	-0.384 *(0.43)*	-0.011 *(1.30)*	-0.005 *(3.36)****	-0.397 *(1.16)*	-0.005 *(1.88)**	-0.000 *(0.01)*	-0.007 *(1.07)*
Export	-0.006 *(1.06)*	-0.183 *(1.43)*	-0.007 *(2.87)****	-0.001 *(1.06)*	-0.107 *(0.97)*	-0.005 *(1.64)*	-0.019 *(1.22)*	-0.009 *(1.32)*
RegElect	0.077 *(0.54)*	0.323 *(0.60)*	0.228 *(1.94)**	0.042 *(0.83)*	1.006 *(1.92)**	0.053 *(0.86)*	-0.025 *(0.16)*	0.068 *(0.60)*
RegWeb	-2.641 *(2.43)***	2.138 *(1.26)*	0.329 *(0.94)*	-0.426 *(2.07)***	0.768 *(0.50)*	-0.757 *(3.39)****	-1.542 *(1.77)**	-0.847 *(1.57)*
Cred	-1.011 *(2.08)***	-2.421 *(2.42)***	-0.403 *(2.74)****	-0.144 *(2.38)***	-1.842 *(2.07)***	-0.085 *(1.02)*	-0.304 *(1.25)*	-0.554 *(2.26)***
AccessF	0.006 (0.11)	0.118 (0.65)	0.059 (1.41)	0.044 (2.34)**	-0.022 (0.11)	0.068 (2.43)**	0.126 (1.74)*	-0.051 (1.22)
Training	-0.135 *(0.43)*	0.234 *(0.33)*	-0.142 *(0.93)*	-0.217 *(3.23)****	0.428 *(0.56)*	-0.123 *(1.22)*	-0.400 *(1.34)*	-0.103 *(0.59)*
EduM	-0.148 (2.02)**	-0.282 (1.53)	-0.076 (2.08)**	-0.064 (3.03)***	-0.673 (2.61)***	-0.073 (1.96)*	-0.096 (1.46)	-0.158 (2.84)***
ExpM	-0.037 *(2.26)***	0.045 *(1.50)*	-0.000 *(0.05)*	-0.003 *(0.90)*	0.014 *(0.48)*	-0.002 *(0.38)*	-0.006 *(0.56)*	-0.000 *(0.04)*
RegLregul	0.024 *(0.13)*	-0.827 *(1.52)*	-0.069 *(0.50)*	0.007 *(0.10)*	0.362 *(0.70)*	0.020 *(0.20)*	-0.112 *(0.53)*	-0.006 *(0.05)*
RegCorrup	0.081 *(0.51)*	0.074 *(0.17)*	0.168 *(1.53)*	-0.054 *(0.96)*	-0.272 *(0.59)*	-0.008 *(0.11)*	0.073 *(0.52)*	0.124 *(1.40)*
Constant	1.460 *(2.87)****	-2.422 *(1.25)*	1.493 *(2.00)***	3.388 *(5.45)****	-2.612 *(1.34)*	2.358 *(4.94)****	1.279 *(1.91)**	1.568 *(2.66)****
Observations	942	380	1601	1494	838	695	774	480
sigma_u	0.75	1.69	0.77	0.90	1.46	0.75	1.10	0.64
sigma_v	0.86	0.81	0.54	0.43	0.76	0.46	0.57	0.67
Wald chi2	1351.45	2787.67	241.01	1306.40	2484.52	1060.30	1321.23	300.67
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The one step procedure explains firm-level inefficiency. Variables *Size*, *Foreign* and *Export* are expected with a negative coefficient. All regressions contain country-dummy variables when estimating the production function. * Significant at 10%; ** significant at 5%; *** significant at 1%. Absolute value of z statistics are in parentheses.
Source. Authors' estimations.

A first set of conclusions concerns the production frontiers. Our regressions confirm the choice to estimate a production frontier by industry. Elasticites of capital and labor reveal to be different from one industry to another. Impact of capital is strong in *Chemicals & Pharmaceutical Products*, *Agro-Processing* and, to a lower extend, *Textile*. On the opposite, elasticity of labor is higher in *Metal & Machinery*, *Non Metal & Plastic Materials*, *Wood & Furniture*, *Leather* and *Garment*. These industries look like being more intensive in labor, although two of them: *Metal & Machinery* and *Non Metal & Plastic Materials*, are usually considered as applying more capitalistic technologies in developed economies. This result is confirmed by the computation of the ratio of the two elasticities (capital/ labor). All coefficients are highly significant (at 1% level), what stresses the robustness of our results

Another result shows that we are close to the constant returns to scales, legitimating the hypothesis underlying the non parametric *TFP* measures (see section 2.1). Our estimations also highlight that some differences in production frontiers can be explained by countries specific conditions. This hypothesis is supported by the data, as country-dummies are well significant at this stage of estimations.

More interesting, our estimations verify that differences in the investment climate participate in firms' Technical Efficiencies (*TE*) discrepancies. This is true for all aspects of the investment climate, except for the "Government-Business" relations. Our results confirm that a good quality of infrastructure (proxied by the quality of the electric network and the availability of internet access), a satisfactory access to financing, as well as the availability of expertise at the firm level (such as education and experience of the manager, and training of the employees) are important factors for enterprises productive performances. This outcome, which is consistent with the theory, makes a real contribution to the empirical literature by validating, for a large sample of industrial firms in developing countries, the role of a substantial set of *IC* variables on firms' productive performances.

This finding appears, however, quite different from one industry to another. First, as expected, it looks like that estimation has suffered from the colinearity of several *IC* variables. In fact, although each broad category of *IC* variables (except Government-Business Relation) ends up being significant in almost all industries, it is very rare to find two significant *IC* variables in the same category[40]. Impact of *IC* variables can also vary. Access to credit seems more detrimental in *Leather, Metal & Machinery Products* and *Textile* (the estimated coefficient of this variable in higher than in the other industries). Access to the internet looks more critical in *Textile* and *Wood & Furniture*. As for Human Capacity, the education of the top manager should be more a high priority in *Metal & Machinery Products*, *Textile* and *Non Metal & Plastic Materials.* Interestingly, *Textile* and *Metal & Machinery Products* look more sensitive to *IC* deficiencies. Beside, firms' performances depend on more dimensions of the *IC* in these two sectors. This finding may be explained by the fact that these industries are more exposed to international competition and need a supportive investment climate to be able to compete efficiently.

As for Business-Government Relations, neither labor regulations (*RegLreg*), nor corruption (*RegCorrup*) emerge as an obstacle to firms productive performance, although this outcome has to be considered with caution because of the probably high correlation between explanatory variables. Difficulties have also occurred in validating the impact of other individual variables. Firms' size (*Size*) and foreign ownership of capital (*Foreign*) justify scales economies and externalities linked to participation of foreign capital in just two sectors (*Agro-Processing,* and *Chemical & Pharmaceutical Products*). Export orientation (*Export*) appears as a determinant of productivity in only one industry: *Garment.* This result meets, however, with what we know about this sector, where external competitive markets are a stimulating source for a high productivity level. Identically, regressions results are poor in two sectors: *Leather* and *Wood & Furniture*[41]. All these difficulties, when individual factors are considered, explain why we have then focused our analysis on a few *IC* composite indicators. These indicators are tested econometrically in the next section.

7.2- Common Model with Composite Indicators of Investment Climate

In this specification, the *IC* individual variables have been replaced by our four composite indicators: Quality of Infrastructure (*Infra*), Business-Government Relations (*Gov*), Human Capacity (*H*), and Financing Constraints (*Fin*). This model allows introducing much more *IC* variables than previously[42]. Like in the first empirical model, we have considered a same representation for all industries. The model is still estimated at the branch level and explains the logarithm of the firms' value added and Technical Efficiency (*TE*) in one step. Other control variables are unchanged. The model is as follows:

$$\ln(y_{i,j}) = c_i + \acute{\alpha}_1 \ln(l_{i,j}) + \acute{\alpha}_2 \ln(k_{i,j}) + \beta\, Size_{i,j} + \gamma\ Foreign_{i,j} + \delta\, Export_{i,j}$$

$$+ \varepsilon_1 RegInfra_{i,j} + \varepsilon_2\ , RegGov_{i\,j} + \varepsilon_3\ H_{i,j} + \varepsilon_4\ Fin_{i,j} + c + v_{i,j}: \qquad (11)$$

Estimation results reinforce our previous findings (see Table 7). Production frontiers are robust to the introduction of different *IC* variables, with little changes in returns to scales or in the elasticities of production factors across industries. Countries specific conditions are also validated by the data.

One of the most interesting outcomes, nevertheless, concerns the investment climate which four dimensions are now significant with the expected sign. As we actually explain firm-level inefficiency, a positive coefficient is expected for three out of our four indicators. This is the case of *RegInfra*, *RegGov* and *Fin*, which are interpreted as obstacle for the operation of the firms. On the opposite, *H* being constituted of variables which are supposed to improve Technical Efficiency, a negative coefficient is expected for this variable (see section 5 for the definition of the axes of the composite indicators). Beside, our model validates the impact of a much more substantial number of *IC* variables incorporated in the aggregated indicators. This result has to be stressed because it is the first time (to our knowledge) that the empirical literature brings evidence of the role of such a significant set of *IC* variables for such a large and diversified sample of industrial firms. It is also of first important for MENA, knowing the deficiencies of different dimensions of the investment climate which improvement could constitute a powerful mean of boosting firms' efficiency and of catching up with more efficient and competitive countries. Improving the financial environment in *Morocco*, the government-business relation in *Egypt*, *Saudi Arabia* and *Lebanon*, and the quality of infrastructure in *Lebanon* in particular would go in this direction.

Findings by industry bring, as well, quite interesting comments. Human Capacity (*H*), Infrastructure (*Infra*), and Financing Constraints (*Fin*) appear to be the most robust investment climate factors for firm-level productivity. All three broad indicators explain quite well productivity discrepancies in most industries while Business-Government Relations (*Gov*) constitutes a less constant dimension. Our empirical analysis also reveals that some industries: *Textile* (for *H*, *Infra* and *Fin*), *Metal & Machinery Products* (for *H* and *Gov*) and *Wood & Furniture* (for *H* and *Fin*) appear more sensitive and vulnerable than others in front of a deficit of their investment climate (the estimated coefficients of the *IC* variables are higher for these industries). This comment may be extended to *Non Metal & Plastic Materials* and *Garment* for, respectively, Human Capacity (*H*) and Government-Business Relation (*Gov*).

These findings confirm in a different way some conclusions of the previous model. As mentioned before, this result may be due to the fact that most of these industries face international competition. This fragility justifies that a particular attention be paid when taking decisions that may affect these sectors' investment climate. This also means that the pay off of an improvement of the investment climate would be more substantial in these industries, which could play a leading role in the industrial capacity and export development of the countries. This conclusion is all the more important for the MENA economies, knowing the high specialization of some of them (*Morocco* and *Egypt* in particular) in the *Textile* and *Garment* industries (see Table 2 *Annex 7*). Improving the investment climate in these two sectors would greatly help to resist to the strong international competitions and reinforce the export orientation of the two countries.

Table 7. Estimation Results: Common Model with Aggregated *IC* Variables
(Dependant Variable: Value Added)

Independent Variables	Textile	Leather	Garment	Agro Industry	Metal & Machinery Products	Chemic &Pharm Products	Wood & Furniture	Non Metal & Plastic Materials
ln(l)	0.637	0.778	0.879	0.551	0.885	0.578	0.836	0.923
	*(16.01)****	*(27.90)****	*(15.19)****	*(12.54)****	*(25.26)****	*(11.84)****	*(17.87)****	*(15.50)****
ln(k)	0.337	0.252	0.196	0.397	0.258	0.447	0.248	0.254
	*(15.06)****	*(16.57)****	*(7.40)****	*(24.54)****	*(13.11)****	*(20.05)****	*(11.91)****	*(9.31)****
Intercept	1.081	2.149	1.326	4.302	1.883	2.868	1.738	1.223
	*(2.01)***	*(5.93)****	*(4.62)****	*(5.77)****	*(5.90)****	*(4.26)****	*(4.54)****	*(2.78)****
Size	-0.809	-0.333	-0.037	-0.212	-0.159	-0.198	-0.490	0.273
	(1.54)	*(1.77)**	*(0.33)*	*(2.75)****	*(0.22)*	*(1.99)***	*(2.22)***	*(1.10)*
Foreign	-0.426	-0.006	-0.014	-0.005	-0.541	-0.006	0.004	-0.019
	(0.90)	*(0.76)*	*(0.50)*	*(3.48)****	*(1.05)*	*(1.72)**	*(0.54)*	*(1.28)*
Export	-0.016	-0.020	-0.078	-0.001	-0.114	-0.008	-0.017	-0.186
	(0.81)	*(1.95)**	*(1.81)**	*(1.14)*	*(1.04)*	*(1.49)*	*(1.53)*	*(1.08)*
RegInfra	0.762	-0.079	-0.057	0.014	0.833	0.204	0.262	0.318
	*(2.52)***	*(0.66)*	*(0.95)*	*(0.27)*	*(1.83)**	*(2.35)***	*(1.71)**	*(2.32)***
H	-0.716	-0.138	-0.116	-0.253	-1.174	-0.147	-0.488	-0.768
	*(1.76)**	*(0.79)*	*(1.08)*	*(5.03)****	*(1.52)*	*(1.71)**	*(2.33)***	*(2.24)***
RegGov	-0.259	-0.072	0.185	-0.047	0.706	-0.068	-0.060	0.136
	(1.21)	*(0.72)*	*(2.48)***	*(1.48)*	*(1.70)**	*(1.39)*	*(0.54)*	*(0.86)*
Fin	0.778	0.219	0.035	0.124	0.257	0.148	0.330	-0.208
	*(2.40)***	*(1.68)**	*(0.50)*	*(3.86)****	*(0.54)*	*(2.67)****	*(2.36)***	*(1.26)*
Constant	-0.961	0.162	0.506	3.243	-6.121	1.508	0.703	-0.522
	(0.95)	*(0.19)*	*(1.84)**	*(4.82)****	*(2.83)****	*(2.32)***	*(1.04)*	*(0.71)*
Obs	929	433	1555	1481	826	741	750	461
sigma_u	1.31	1.11	0.25	0.91	1.98	0.70	1.10	0.56
sigma_v	0.86	0.60	0.73	0.37	0.65	0.56	0.53	0.75
Wald chi2	1579.56	2375.90	925.66	1343.79	3117.04	1010.55	1490.81	893.91
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The one step procedure explains firm-level inefficiency. The expected sign of the *IC* aggregated variables is positive for *RegInfra*, *RegGov* and *Fin*, and negative for H (see definition of variables in section 5). Variables *Size*, *Foreign* and *Export* are also expected with a negative coefficient. All regressions contain country-dummy variables when estimating the production function. * Significant at 10%; ** significant at 5%; *** significant at 1%. Absolute value of z statistics are in parentheses.
Source. Authors' estimations

By using our *IC* aggregate indicators, however, we don't always better explain productivity. This is somehow the case of *Metal & Machinery Products* and *Agro-Processing*, but essentially of *Garment* for which a very few aspects of the investment climate seem to help firms to perform better[43]. No improvement is seen, either, in *Leather*, which is again poorly explained by the model. This fact is, however, largely compensated by the tremendous gain of information through the large set of *IC* variables now explaining firm-level productive performances, as well as by the validation of another variable of interest: the Government-Business Relation (*Gov*)[44]. We will also show in the next section that Garment is better explained by the data, when dealing with small and medium domestic firms.

Another addition of the model consists in validating the role of more plants characteristics in explaining firm-level Technical Efficiency (*TE*). This is true for the variable *Size*, which justify scales economies in four industries instead of two previously: *Wood & Furniture* and *Leather* in addition to *Agro-Processing* and *Chemicals & Pharmaceutical Products*. This constitutes an interesting result that would justify a policy of concentration of small enterprises, which importance in developing countries is well documented. Concentration could be seen as a powerful means of boosting efficiency and competitiveness of the industrial sector, thus contributing to industrial development and economic growth. Besides, export orientation (*Export*) explains externalities linked to export activities in *Leather*, in addition to *Garment* (with a stronger coefficient for *Garment*), what confirms the exposure to international competition of these two industries. Increase the export capacity of some industries appears, though, as another mean to stimulate firm's efficiency and to promote a diversified economic growth, where industry is subject to play a major role.

7.3- Technical Efficiency and Endogeneity of Firms' Implantation

Another test of robustness has consisted in addressing the question of a possible endogeneity in firms' location. City or region-sector averages *IC* indicators would not be exogenous regressors if, for example, more efficient firms tend to establish in locations where the investment climate is better. In order to evaluate this bias, we have re-run our previous model on a set of firms which are less likely to choose their location. This had led to eliminate foreign firms and large domestically owned firms. Following Dollar et *al*. (2005), we define our new sample as the domestically owned firms employing less than 150 workers[45]. Results of this new set of estimations still confirm our previous findings (see Table 8).

A first conclusion concerns the investment climate, which impact on firms' performances is still validated by the data. This is true for all four dimensions of the investment climate. This result confirms that small and medium domestic firms are sensitive as well to changes in the different dimensions of the investment climate.

A detailed analysis also reveals that the influence of the investment climate can be different for this category of firms. This is the case in *Textile*, *Garment* and *Non Metal & Plastic Materials*, where impact of *IC* variables is stronger than for the whole sample (see section 6.2). In *Textile*, this is true for all three significant dimensions of the investment climate (*Infra, H* and *Fin).* In *Garment*, Financing Constraints *(Fin)* and Infrastructure (*Infra)* appear now as constraints for small firms' productive performances, in addition to a stronger impact of Business-Government Relations (*Gov*). Besides, small firms in *Non Metal & Plastic Material* are more sensitive to limitations in Infrastructure (*Infra)* and Human Capacity *(H).* This outcome is likely to show that, in the three industries, big and foreign firms can resist more to a degradation of the investment climate. This finding also tends to confirm that big enterprises have the possibility to influence positively their investment climate, or to establish in locations where the investment climate is more favorable.

This outcome can be considered as of first importance, knowing the potential of job creation of small and medium enterprises. Actually, it is well documented that small businesses generally deal with poor investment climate. They have, for example, a more difficult and more expensive access to the financial system. They have not the power, as well, to lobby policy makers to get better regulations. They also attract less qualified people who prefer higher salaries in bigger enterprises. They have less the capacity to compensate deficient infrastructure, buying a generator or paying for expensive internet connections (in addition to the fact that they don't choose their location (see World Bank, 2005). This makes of this category of firms a great potential for an improved performances of the industrial sector. This is particularly true for our MENA economies, which are characterized by a relatively small size of firms (see Table 1 *Annex* 7).

It is also interesting to note that, when focusing on small and medium domestic firms, we find that more *IC* variables explain firm-level performances. This is due to the fact that big enterprises are less sensitive to *IC* limitations and bias downward the estimated coefficients when dealing with the whole sample. Restricting the sample to small and medium firms better highlights the impact of *IC* and firms characteristics on firm-level performances and competitiveness, thus drawing more substantial policy implications. This is well illustrated by the case of *Garment*, for which very few *IC* variables were previously significant.

Table 8. Estimation Results: Common Model with Aggregated *IC* Variables and Sample Differentiation (domestic firms with less than 150 employees)

(Dependant Variable: Value Added)

Independent Variables	**Textile**	**Leather**	**Garment**	**Agro Industry**	**Metal & Machinery Products**	**Chemic &Pharm Products**	**Wood & Furniture**	**Non Metal & Plastic Materials**
ln(l)	0.547 *(9.01)****	0.882 *(23.30)****	0.975 *(15.3)****	0.460 *(5.92)****	0.834 *(15.85)****	0.549 *(6.74)****	0.779 *(11.39)****	0.981 *(14.07)****
ln(k)	0.319 *(12.38)****	0.252 *(16.25)****	0.177 *(6.06)****	0.384 *(18.61)****	0.251 *(10.87)****	0.390 *(13.89)****	0.223 *(10.01)****	0.252 *(8.74)****
Intercept	2.153 *(4.18)****	1.732 *(5.00)****	-0.309 *(0.93)*	2.105 *(2.33)***	1.903 *(4.86)****	2.426 *(3.11)****	2.238 *(3.16)****	1.024 *(2.42)***
Size	-2.897 *(1.91)**	0.045 *(0.27)*	0.186 *(0.84)*	-0.357 *(2.88)****	-2.331 *(1.76)**	-0.345 *(2.44)***	-0.412 *(2.51)***	0.678 *(1.37)*
Export	-0.417 *(0.98)*	-0.010 *(1.85)**	-0.003 *(0.81)*	-0.005 *(1.79)**	-0.475 *(0.99)*	-0.016 *(1.49)*	-0.013 *(1.62)*	-0.316 *(0.95)*
RegInfra	1.170 *(2.13)***	-0.127 *(1.09)*	0.763 *(2.97)****	0.007 *(0.09)*	0.869 *(2.01)***	0.161 *(1.83)**	0.157 *(1.60)*	0.472 *(1.72)**
H	-1.352 *(2.04)***	-0.133 *(0.86)*	-0.276 *(0.77)*	-0.201 *(2.82)****	-1.103 *(1.35)*	-0.108 *(1.23)*	-0.263 *(2.50)***	-1.444 *(2.09)***
RegGov	-0.171 *(0.51)*	-0.105 *(1.17)*	1.552 *(2.88)****	-0.045 *(1.05)*	0.424 *(0.94)*	-0.067 *(1.48)*	-0.063 *(0.81)*	0.154 *(0.54)*
Fin	1.170 *(2.05)***	0.222 *(1.97)***	0.665 *(3.33)****	0.093 *(1.96)***	0.496 *(0.99)*	0.146 *(2.60)****	0.178 *(2.42)***	-0.520 *(1.57)*
Constant	-0.254 *(0.15)*	-0.348 *(0.44)*	-3.389 *(2.40)***	1.894 *(2.58)****	-1.468 *(0.73)*	1.509 *(3.33)****	1.389 *(3.36)****	-2.307 *(1.40)*
Observations	730	359	1093	1123	639	607	650	395
sigma_u	1.42	1.02	0.28	0.73	1.41	0.43	0.80	0.91
sigma_v	0.90	0.45	0.73	0.77	0.71	0.80	0.51	0.69
Wald chi2	663.77	1615.42	763.09	787.50	1175.83	479.31	576.56	796.86
Prob > chi2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: The one step procedure explains firm-level inefficiency. The expected sign of the *IC* aggregated variables is positive for *RegInfra*, *RegGov* and *Fin*, and negative for H (see definition of variables in section 5). Variables *Size*, *Foreign* and *Export* are also expected with a negative coefficient. All regressions contain country-dummy variables when estimating the production function. * Significant at 10%; ** significant at 5%; *** significant at 1%. Absolute value of z statistics are in parentheses.

Source. Authors' estimations

In addition, our estimations confirm once more that it is the small and medium firms more exposed to international competition that suffer the most of the deficiencies of their *IC*. This is particularly true for *Textile* and *Garment*, but also to some extent for *Non Metal & Plastic Material*. This finding still verifies that an improvement of the *IC* would particularly benefit to this category of firms, which competitiveness and export capacity could be significantly boosted.

Finally, another result tends to confirm the importance of the size as a factor of productivity and efficiency. Actually, small and medium domestic firms appear to gain more from concentration than big and foreign ones (what looks like a reasonable outcome). This is the case in *Textile* and *Metal & Machinery Products* where the variable *Size* is now significant, as well as in *Agro-Processing* and *Chemicals & Pharmaceutical Products* where the coefficient of this variable shows a significant increase compared to previous estimations. This constitutes an interesting result that would again justify a policy of concentration of small enterprises[46].

8- Conclusions

In this paper, we have empirically verified that investment climate (*IC*) matters for firms' productive performance. This finding is true for several aspects of the investment climate, in particular the quality of various infrastructures, the experience and education of the labor force, the cost and access to financing, as well as different dimensions of the government-business relation. This outcome (which is consistent with the theory) makes a real contribution to the empirical literature by validating, for a large sample of industrial firms in developing countries, the role of a substantial set of *IC* variables.

Policy implications of our findings are comprehensible by showing what determinants of productivity cause producers to be more efficient, and where should reform be targeted to have the greatest impact on productivity. In most industries, it is the dimension of infrastructures, human capacity and/or financing that more often account for firms' productive performance. Building on these three dimensions of the investment climate would have a large pay-off for the efficiency and competitiveness of the manufacturing industry as a whole. This factor should be kept in mind when dealing with the reform agenda of many developing countries, the MENA region in particular, in which poor investment climate hinders economic development and catch-up with more efficient and competitive countries.

A more in-depth analysis also reveals interesting differences across industries. Actually, although most industries appear sensitive to different dimensions of the investment climate, firms in *Textile* and *Metal & Machinery Products* look like to suffer more of investment climate limitations. This comment may be broadened, to some extent, to *Non Metal & Plastic Materials* and *Garment.* This may be due to the fact that these sectors face international competition and need a supportive investment climate to compete efficiently. This fragility justifies that a particular attention be paid when taking decisions that may affect these sectors. This also means that the pay off of an improvement of the investment climate in terms of productive performances and competitiveness would be more substantial in these industries, which could play a leading role for the industrial capacity and export development of the countries.. This result constitutes an important means of appreciation of the positive impact of investment climate improvement since MENA manufacturing suffers from a deficient integration into the world economy, as well as from a high competition in the world market.

Another interesting finding can be seen in the fact that impact of investment climate varies for small and medium (under 150 workers) domestic firms. This is the case in *Textile*, *Garment* and *Non Metal & Plastic Materials*, where investment climate constraints emerge stronger than for the whole sample. This result is likely to show that, in these industries, big and foreign firms have the possibility to influence positively their business environment, and/or establish in locations where the investment climate is better. This finding also implies that improvement of the investment climate of small and medium enterprises in these industries would generate substantial productivity gains and largely boost competitiveness of this category of firms. This outcome has to be considered as of first importance, knowing the significance of small enterprises in developing countries, MENA in particular, as well as their substantial potential of job creation. Interestingly, another result tends to confirm the importance of the size as factor of productivity and efficiency. Actually, small domestic firms appear to gain more from concentration than big and foreign ones. This is the case in *Textile* and *Metal & Machinery Products*, in addition to *Agro-Processing* and *Chemicals & Pharmaceutical Products.* This constitutes an interesting result that would justify a policy of concentration of small enterprises as a powerful means of efficiency and competitiveness of the industrial sector, thus contributing to industrial development and economic growth

Actually, like other developing countries, MENA is increasingly concerned about improving competitiveness and productivity as the region face the intensifying pressure of globalization. This is particularly true in MENA *Textile*, *Garment* and *Leather* industries, in which export specialization can be high in some countries. Among the region, the World Bank firm-surveys provide a standard instrument for identifying key obstacles to productivity, and prioritize policy reforms. This instrument can be used to boost competitiveness and diversify MENA economies. This factor should be taken into consideration if MENA wants to face the increasing international competition of countries such as *China* and *India*, which have successfully diversify their economy and benefit, in addition, from low labor costs. Targeting reforms on small and medium enterprises, as well as on those industries and investment climate variables which are the most inadequate and which favor the most productivity would constitute an important element of MENA strategy of growth and employment for the future.

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Annex 1: List of countries

MENA*	LAC	AFR	SAS	EAP
Algeria (2002)	Brazil (2003)	Ethiopia (2002)	Bangladesh (2002)	China (2002)
Egypt (2004/2006)	Ecuador (2003)	South Africa (2003)	India (2000/2002)	Philippines (2003)
Morocco (2000/2004)	El Salvador (2003)	Tanzania (2003)	Pakistan (2002)	Thailand (2004)
Lebanon (2006)	Guatemala (2003)	Zambia (2002)	Sri Lanka (2004)	
Saudi Arabia(2005)				
	Honduras (2003)			
	Nicaragua (2003)			

MENA : Middle East and North Africa; ***LAC:*** Latin America and the Caribbean; ***AFR*** : Sub Sahara Africa; ***SAS:*** South Asia; ***EAS*** : East Asia.

Annex 2a: ICA Surveys: Data Limitations

Industries/ (number of firms and %)	**Textile**	**Garment**	**Leather**	**Agro-Processing**	**Metal & Machinery Products**	**Chemical & Pharmac. Products**	**Non Metal & Plastic Materials**	**Wood & Furniture**	**Total**
Total Enterprises	2496	3794	821	2815	2163	1728	1159	1317	16293
MENA Enterprises	761	906	257	655	758	364	487	199	4387
(% total)	*(30%)*	*(24%)*	*(31%)*	*(23%)*	*(35%)*	*(21%)*	*(42%)*	*(15%)*	*(27%)*
Total Frontier	1998	2796	634	2184	1604	1270	897	1031	12414
(% total enterprises)	*(80%)*	*(74%)*	*(77%)*	*(78%)*	*(74%)*	*(73%)*	*(77%)*	*(78%)*	*(76%)*
MENA Frontier	541	711	167	436	538	241	335	120	3073
(% total MENA)	*(69%)*	*(78%)*	*(65%)*	*(67%)*	*(71%)*	*(66%)*	*(69%)*	*(59%)*	*(70%)*
(% total frontier)	*(26%)*	*(25%)*	*(26%)*	*(20%)*	*(34%)*	*(19%)*	*(37%)*	*(11%)*	*(25%)*
Total with *IC* variables	942 *(38%)*	1604 *(42%)*	380 *(46%)*	1525 *(54%)*	841 *(39%)*	738 *(43%)*	478 *(41%)*	778 *(59%)*	5002 *(45%)*
MENA with *IC* variables	215	371	91	228	258	95	162	63	1483
(% total MENA)	*(28%)*	*(41%)*	*(35%)*	*(35%)*	*(34%)*	*(26%)*	*(33%)*	*(32%)*	*(34%)*
(% total IC)	*(23%)*	*(23%)*	*(24%)*	*(15%)*	*(31%)*	*(13%)*	*(34%)*	*(8%)*	*(30%)*

Sources: Authors' calculations.

Annex 2b: ICA Surveys: Data limitations

Industry (number of firms and %)	Countries	Total	Frontier	IC variables
Textile	***Algeria*** *(2002)*	79	27 *(34%)*	
	Egypt *(2004)*	141	92 *(65%)*	66 *(47%)*
	Morocco *(2000)*	200	142 *(71%)*	
	Lebanon *(2006)*	11	5 *(45%)*	5 *(45%)*
	Morocco *(2004)*	160	148 *(93%)*	144 *(90%)*
	Egypt *(2006)*	170	111 *(67%)*	
Leather	***Algeria*** *(2002)*	14		
	Egypt *(2004)*	44	29 *(66%)*	19 *(43%)*
	Morocco *(2000)*	68	36 *(53%)*	
	Lebanon *(2006)*	15		
	Morocco *(2004)*	80	77 *(96%)*	72 *(90%)*
	Egypt *(2006)*	36	25 *(69%)*	
Garments	***Egypt*** *(2004)*	120	87 *(73%)*	52 *(43%)*
	Morocco *(2000)*	316	216 *(68%)*	
	Lebanon *(2006)*	27	13 *(48%)*	13 *(48%)*
	Morocco *(2004)*	334	315 *(94%)*	314 *(94%)*
	Egypt *(2006)*	109	83 *(76%)*	
Agro Processing	***Algeria*** *(2002*	51	27 *(53%)*	
	Egypt *(2004)*	156	115 *(74%)*	90 *(58%)*
	Morocco *(2000)*	83	44 *(53%)*	
	Lebanon *(2006)*	49	16 *(33%)*	14 *(29%)*
	Morocco *(2004)*	72	60 *(83%)*	58 *(81%)*
	Saudi Arabia *(2005)*	94	75 *(80%)*	66 *(70%)*
	Egypt *(2006)*	150	107 *(71%)*	

Metal & Machinery Products	***Algeria*** *(2002)*	110	47 *(43%)*	
	Egypt *(2004)*	168	119 *(71%)*	88 *(52%)*
	Morocco *(2000*	38	27 *(71%)*	
	Lebanon *(2006)*	7		
	Morocco *(2004)*	19	19 *(100%)*	19 *(100%)*
	Saudi Arabia *(2005)*	185	163 *(88%)*	136 *(74%)*
	Egypt *(2006)*	231	163 *(71%)*	
Chemical & Pharm. Products	***Algeria*** *(2002*	52	25 *(48%)*	
	Egypt *(2004*	65	52 *(80%)*	41 *(63%)*
	Morocco *(2000*	77	44 *(57%)*	
	Lebanon *(2006)*	6		
	Morocco *(2004)*	61	56 *(92%)*	54 *(89%)*
	Egypt *(2006)*	103	64 *(62%)*	
Wood & Furniture	***Egypt*** *(2004)*	58	31 *(53%)*	19 *(33%)*
	Lebanon *(2006)*	37	11 *(30%)*	11 *(30%)*
	Morocco *(2004)*	3		
	Saudi Arabia *(2005)*	51	37 *(73%)*	33 *(65%)*
	Egypt *(2006)*	50	38 *(78%)*	
Non Metal & Plastic Materials	***Algeria*** *(2002)*	85	41 *(48%)*	
	Egypt *(2004)*	169	126 *(75%)*	93 *(55%)*
	Morocco *(2000)*	77	48 *(62%)*	
	Lebanon *(2006)*	7		
	Morocco *(2004)*	77	69 *(90%)*	69 *(90%)*
	Egypt *(2006)*	72	51 *(71%)*	

Source.:Authors' calculations

Annex 3: **Labor Productivity (*LP*) and Labor Cost** (*1000 dollars*)

Country	**Wage per capita** (*average*)	**Wage per capita** (*median*)	**Labor Productivity** (*average*)	**Labor Productivity** (*median*)	**Unit Labor Cost** (*average*)	**Unit Labor Cost** (*median*)	**Number of firms**
Textile							
MENA	**2.43**	**2.20**	**7.84**	**4.91**	**0.54**	**0.42**	**272**
Algeria (2002)	1.64	1.66	4.27	3.58	0.57	0.44	27
Egypt (2004)	0.71	0.65	4.78	1.93	0.45	0.31	92
Egypt (2006)	0.84	0.82	3.47	1.87	0.50	0.38	127
Lebanon (2006)	0.64	0.66	1.83	1.49	0.44	0.33	5
Morocco (2000)	3.46	2.98	11.74	7.42	0.42	0.38	142
Morocco (2004)	3.71	3.31	10.61	7.11	0.60	0.49	148
Non MENA	**1.90**	**1.34**	**9.99**	**5.47**	**0.39**	**0.27**	**1256**
China (2002)	3.76	1.45	11.35	6.90	0.35	0.24	39
India (2000)	1.50	1.07	10.64	5.15	0.28	0.22	216
India (2002)	1.58	0.94	10.48	4.66	0.42	0.19	195
Leather							
MENA	**2.50**	**2.10**	**5.41**	**3.74**	**0.64**	**0.56**	**106**
Egypt (2004)	0.71	0.51	3.49	1.18	0.51	0.49	29
Egypt (2006)	0.74	0.59	1.40	0.87	1.92	0.64	25
Morocco (2000)	2.69	2.51	5.91	5.50	0.61	0.47	36
Morocco (2004)	3.18	2.70	6.13	4.70	0.69	0.59	77
Non MENA	**1.70**	**1.38**	**6.80**	**4.03**	**0.47**	**0.35**	**467**
Chine (2002)	1.68	1.27	8.04	4.05	0.38	0.31	53
India (2002)	1.19	0.74	7.55	3.89	0.34	0.20	57
Garments							
MENA	**2.24**	**2.06**	**5.31**	**3.43**	**0.67**	**0.57**	**415**
Egypt (2004)	0.68	0.59	1.78	1.10	0.79	0.50	87
Egypt (2006)	0.70	0.60	2.27	1.11	0.61	0.50	83
Lebanon (2006)	0.42	0.40	2.20	1.27	0.90	0.35	13
Morocco (2000)	2.53	2.25	5.28	4.28	0.56	0.55	216
Morocco (2004)	2.74	2.54	6.42	4.17	0.63	0.60	315
Non MENA	**1.96**	**1.36**	**6.60**	**3.33**	**0.73**	**0.42**	**1903**
Chine (2002)	2.86	1.12	12.35	3.50	0.46	0.36	93
India (2000)	1.34	0.84	7.17	3.74	0.30	0.25	186
India (2002)	1.10	0.89	7.38	4.11	0.36	0.23	206
Agro-Processing							
MENA	**3.77**	**3.04**	**15.87**	**10.01**	**0.46**	**0.32**	**293**
Algeria (2002)	2.39	1.99	6.71	4.93	0.53	0.35	27
S. Arabia (2005)	6.78	6.21	27.93	18.42	0.37	0.36	75
Egypt (2004)	0.92	0.62	4.87	2.22	0.40	0.31	115
Egypt (2006)	3.11	0.73	9.28	2.91	0.38	0.29	107
Lebanon (2006)	0.46	0.45	3.01	1.96	0.29	0.25	16
Morocco (2000)	6.16	3.36	24.27	20.23	0.34	0.24	44
Morocco (2004)	6.99	4.87	29.43	18.87	0.72	0.30	60
Non MENA	**2.50**	**1.67**	**14.91**	**6.40**	**0.46**	**0.27**	**1751**
India (2002)	2.20	0.86	21.10	4.94	0.44	0.17	167

Annex 3: Labor Productivity (*LP*) and Labor Cost (*1000 dollars*) (end)

Country	Wage per capita (*average*)	Wage per capita (*median*)	Labor Productivity (*average*)	Labor Productivity (*median*)	Unit Labor Cost (*average*)	Unit Labor Cost (*median*)	Number of firms
Metal & Machinery Products							
MENA	**5.98**	**4.10**	**19.92**	**10.93**	**0.50**	**0.41**	**348**
Algeria (2002)	2.91	2.51	5.80	3.74	0.80	0.59	47
S. Arabia (2005)	7.01	6.34	26.15	18.32	0.39	0.39	163
Egypt (2004)	5.18	0.79	13.66	2.24	0.55	0.36	119
Egypt (2006)	1.13	0.87	7.23	3.24	0.50	0.30	181
Morocco (2000)	5.02	3.97	18.74	9.49	0.57	0.38	27
Morocco (2004)	9.74	9.58	40.64	19.81	0.44	0.50	19
Non MENA	**4.49**	**3.29**	**16.44**	**8.62**	**0.46**	**0.36**	**999**
Chine (2002)	2.29	1.38	11.96	6.11	0.30	0.25	150
India (2000)	1.58	1.14	9.53	5.48	0.26	0.24	68
India (2002)	2.17	0.96	16.02	4.45	0.33	0.23	140
Chemical & Pharmaceutical Products							
MENA	**5.24**	**4.10**	**21.38**	**12.96**	**0.47**	**0.35**	**133**
Algeria (2002)	2.59	2.32	6.97	5.27	0.66	0.40	25
Egypt (2004)	1.40	0.89	9.26	3.16	0.44	0.36	52
Egypt (2006)	1.75	0.98	8.34	3.04	0.43	0.33	68
Morocco (2000)	6.75	4.51	25.84	17.65	0.34	0.27	44
Morocco (2004)	9.98	7.87	39.06	25.49	0.40	0.31	56
Non MENA	**3.21**	**2.18**	**18.95**	**9.24**	**0.37**	**0.23**	**821**
India (2000)	5.00	1.18	16.72	6.65	0.23	0.19	208
India (2002)	1.86	0.89	12.76	4.72	0.29	0.18	331
Wood & Furniture							
MENA	**3.40**	**3.01**	**8.78**	**7.65**	**0.58**	**0.51**	**81**
S. Arabia (2005)	6.32	5.67	16.86	14.97	0.40	0.36	37
Egypt (2004)	1.07	0.82	2.19	1.71	0.69	0.65	31
Egypt (2006)	0.98	0.87	3.90	1.58	0.95	0.60	39
Lebanon (2006)	0.66	0.64	1.48	1.00	0.81	0.60	13
HORS MENA	**2.67**	**2.23**	**7.54**	**4.77**	**0.58**	**0.45**	**914**
Non Metal & Plastic Materials							
MENA	**2.16**	**1.91**	**8.13**	**4.77**	**0.44**	**0.39**	**237**
Algeria (2002)	2.68	2.50	5.77	4.82	0.69	0.60	41
Egypt (2004)	0.75	0.61	5.18	1.66	0.37	0.34	126
Egypt (2006)	0.82	0.69	9.87	1.97	0.57	0.30	53
Morocco (2000)	3.53	3.14	11.05	8.80	0.53	0.37	48
Morocco (2004)	4.38	3.91	14.83	10.35	0.43	0.36	70
Non MENA	**2.95**	**2.40**	**11.19**	**6.92**	**0.54**	**0.36**	**569**

Source: Authors' calculations

Annex 4: Total Factor Productivity (*TPF*)

	Textile	***Garments***	***Leather***	***Agro-Processing***
Non MENA				
Average	3.85	5.08	4.42	4.75
Median	2.88	4.02	3.94	3.51
MENA				
Average	3.91	5.35	4.13	4.31
Median	2.87	3.97	3.20	3.09
Efficient Country	***Brazil*** *(2003)*	***Brazil*** *(2003)*	***Brazil*** *(2003)*	***Brazil*** *(2003)*
Average	6.06	6.82	6.20	7.37
Median	4.71	5.14	5.71	5.61
Algeria (2002)				
Average	3.65			3.75
Median	3.06			2.46
Saudi A. (2005)				
Average				5.30
Median				3.94
Egypt (2004)				
Average	3.09	2.90	3.20	3.61
Median	1.94	2.04	2.06	2.17
Egypt (2006)				
Average	2.33	2.36	2.00	2.98
Median	1.76	1.93	1.71	2.32
Lebanon (2006)				
Average	3.40	6.03		2.28
Median	1.66	2.29		2.24
Morocco (2000)				
Average	4.57	5.75	4.89	6.27
Median	3.77	4.69	4.60	4.44
Morocco (2004)				
Average	4.49	5.99	4.48	5.20
Median	3.45	4.57	3.63	4.32
China (2002)				
Average	5.48	4.42	3.34	
Median	2.79	3.32	3.31	
India (2000)				
Average	4.38	4.79		
Median	3.16	3.70		
India (2002)				
Average	4.07	4.15	3.65	4.16
Median	2.78	2.88	3.47	3.02

Annex 4: **Total Factor Productivity** (*TPF*) (end)

	Metal & Machinery Products	***Chemical & Pharmac. Products***	***Wood & Furniture***	***Non Metal & Plastic Materials***
Non MENA				
Average	5.55	4.55	4.95	4.56
Median	4.42	3.65	4.22	3.70
MENA				
Average	4 .97	4.77	3.78	3.87
Median	3.56	3.66	3.48	3.03
Efficient Country	***Brazil*** *(2003)*	***Brazil*** *(2003)*	***South Afr*** *(2003)*	***South Afr*** *(2003)*
Average	7.70	7.86	6.98	5.77
Median	6.45	6.27	6.12	5.08
Algeria (2002)				
Average	4.79	4.71		5.04
Median	3.81	4.12		3.87
Egypt (2004)				
Average	3.27	2.93	2.75	3.02
Median	2.18	2.08	2.20	2.20
Egypt (2006)				
Average	3.69	3.15	3.18	2.44
Median	2.21	2.16	1.92	1.94
Morocco (2000)				
Average	5.98	7.19		3.95
Median	4.49	5.67		3.60
Morocco (2004)				
Average	7.70	6.50		4.72
Median	4.54	4.93		4.04
Saudi A. (2005)				
Average	5.94		5.18	
Median	4.37		4.99	
Lebanon (2006)				
Average			2.25	
Median			2.26	
China (2002)				
Average	3.86			
Median	2.89			
India (2000)				
Average	4.54	4.42		
Median	3.77	3.63		
India (2002)				
Average	5.09	3.77		
Median	3.27	3.12		

Annex 5: Technical Efficiency calculated from a Stochastic Frontier

	Textile	Garment	Leather	Agro-Processing
Non MENA				
Average	0.443	0.621	0.639	0.445
Median	0.436	0.623	0.642	0.440
MENA				
Average	0.416	0.658	0.576	0.426
Median	0.417	0.659	0.581	0.426
Efficient Country	***Brazil*** *(2003)*	***South Afr*** *(2003)*	***Brazil*** *(2003)*	***South Afr*** *(2003)*
Average	0.985	0.988	0.977	0.978
Median	0.985	0.988	0.977	0.978
Algeria (2002)				
Average	0.327			0.347
Median	0.337			0.346
Saudi Arabia (2005)				
Average				0.708
Median				0.717
Egypt (2004)				
Average	0.206	0.204	0.295	0.165
Median	0.184	0.205	0.280	0.152
Egypt (2006)				
Average	0.164	0.220	0.150	0.212
Median	0.154	0.215	0.124	0.189
Lebanon (2006)				
Average	0.206	0.227		0.155
Median	0.165	0.216		0.157
Morocco (2000)				
Average	0.663	0.790	0.741	0.698
Median	0.668	0.792	0.754	0.724
Morocco (2004)				
Average	0.571	0.802	0.681	0.684
Median	0.585	0.802	0.695	0.697
China (2002)				
Average	0.455	0.503	0.442	
Median	0.450	0.497	0.444	
India (2000)				
Average	0.467	0.653		
Median	0.462	0.661		
India (2002)				
Average	0.410	0.650	0.551	0.397
Median	0.402	0.653	0.578	0.373

Annex 5: **Technical Efficiency calculated from a Stochastic Frontier** (end)

	Metal & Machinery Products	**Chemical & Pharmac. Products**	**Wood & Furniture**	**Non Metal & Plastic Materials**
Non MENA				
Average	0.617	0.428	0.483	0.618
Median	0.623	0.421	0.481	0.633
MENA				
Average	0.525	0.434	0.455	0.520
Median	0.526	0.430	0.4653	0.516
Efficient Country	***Morocco** (2004)*	***Brazil** (2003)*	***South Africa** (2003)*	***South Africa** (2003)*
Average	0.973	0.984	0.977	0.971
Median	0.973	0.984	0.977	0.971
Algeria (2002)				
Average	0.378	0.372		0.525
Median	0.395	0.363		0.563
Saudi Arabia (2005)				
Average	0.740		0.792	
Median	0.758		0.804	
Egypt (2004)				
Average	0.217	0.168	0.189	0.313
Median	0.190	0.149	0.174	0.292
Egypt (2006)				
Average	0.242	0.139	0.192	0.228
Median	0.217	0.131	0.149	0.214
Lebanon (2006)				
Average			0.131	
Median			0.118	
Morocco (2000)				
Average	0.657	0.820		0.682
Median	0.659	0.816		0.711
Morocco (2004)				
Average	0.973	0.709		0.890
Median	0.973	0.721		0.890
China (2002)				
Average	0.337			
Median	0.337			
India (2000)				
Average	0.441	0.333		
Median	0.452	0.330		
India (2002)				
Average	0.449	0.312		
Median	0.439	0.304		

Annex 6:

Sperman Correlation Coefficient of the Three Measures of Firm-Level Productivity

Textiles
Nobs: 1998

	TE	TFP	LP
TE	1		
TFP	0.7077*	1	
LP	0.7615*	0.6012*	1

Leather
Nobs: 634

	TE	TFP	LP
TE	1		
TFP	0.7703*	1	
LP	0.6427*	0.6756*	1

Garments
Nobs: 2796

	TE	TFP	LP
TE	1		
TFP	0.5571*	1	
LP	0.5675*	0.6370*	1

Agro-Processing
Nobs: 2184

	TE	TFP	LP
TE	1		
TFP	0.7047*	1	
LP	0.7814*	0.5861*	1

Metals & Machinery Products
Nobs: 1604

	TE	TFP	LP
TE	1		
TFP	0.7483*	1	
LP	0.7762*	0.6810*	1

Chemicals & Pharmaceutic Products
Nobs: 1270

	TE	TFP	LP
TE	1		
TFP	0.7349*	1	
LP	0.7542*	0.6270*	1

Wood & Furniture
Nobs: 1031

	TE	TFP	LP
TE	1		
TFP	0.8456*	1	
P	0.8885*	0.7532*	1

Non-Metallic & Plastic Materials
Nobs: 901

	TE	TFP	LP
TE	1		
TFP	0.7394*	1	
LP	0.8028*	0.6293*	1

Note : *: significant at 1%,.
TE : Technical Efficiency, *TFP* : Total Factor Productivity, *LP* : Labor Productivity.
Source : Auhtors' calculations

Annex 7: ICA Surveys:

Table 1 ***Investment Climate and Plant Characteristics (a)***

	MENA			NON MENA			Ho: No diff in means
	Mean	Standard Deviation	Number of firms	Mean	Standard Deviation	Number of firms	[p-values]
Size	127.1	266.9	3075	192.4	555.9	9350	0.0
Export (% sales)	16.8	34.1	2987	18.7	35.0	8815	0.0
Foreign ownership (% K)	8.3	25.4	3072	6.2	21.7	9292	0.0
Use of E-mail (% firms)	52.0	50.0	2289	60.5	48.9	8940	0.0
Use of website (% firms)	26.7	44.2	2550	35.6	47.9	8233	0.0
Telecommunication*	4.7	21.2	2493	11.4	31.8	8635	0.0
Electricity*	18.2	38.6	2512	33.2	47.1	8650	0.0
Transport*	7.6	26.5	2332	15.1	35.8	8634	0.0
% firm with generator	44.9	41.8	3040	35.5	48.6	9332	0.0
% elect from generator	15.3	16.6	2999	6	18.7	9110	0.0
Overdraft facility (% firms)	42.6	49.5	3069	56.4	49.6	8519	0.0
Financing Access*	51.5	50.0	2032	34.7	47.6	8492	0.0
Financing Cost*	56.9	49.5	2051	42.0	49.4	8477	0.0
Top Manager Ed. Level	3.9	1.4	2261	4.3	1.5	8083	0.0
Top Manager Exp. (years)	12.5	10.9	2218	8.0	9.0	8260	0.0
% Workers Formal Training	19.8	39.9	3052	39.8	49.0	9248	0.0
Availability Skilled Workers*	30.1	45.9	2505	24.0	42.7	8625	0.0
	0.0	0.0		0.0	0.0		
Labor Regulation*	26.9	44.3	2505	21.8	41.3	8430	0.0
Tax Rate*	57.0	49.5	2493	41.8	49.3	8628	0.0
Tax Administration*	38.5	48.7	2486	34.8	47.6	8618	0.0
Licence/Operating Permits*	20.8	40.6	2486	15.5	36.2	8408	0.0
Customs/Trade Regulations*	18.4	38.7	2448	24.9	43.2	7844	0.0
Corruption*	40.6	49.1	2489	44.6	49.7	8635	0.0

** Percentage of firms ranking the variable as a major or severe constraint*

Source: Authors calculations

Table 2: Number of firms/ Rank

		Textile		*Leather*		*Garment*	*Agro-Ind*		*Metal*		*Chemical*		*Wood*		*N M*
Algeria (2002)		79		14			51		110		52			***2***	
		20%		*4%*			*13%*		*28%*		*13%*				
Egypt (2004)	*4*	141	*3*	44	*3*	120	**156**	***3***	**168**	***3***	65	***1***	**58**	***1***	
		15%		*5%*		*13%*	*17%*		*18%*		*7%*		*6%*		
Morocco (2000)	***1***	**200**	***2***	**68**	***2***	**316**	83		38	**2**	**77**			*3*	
		23%		*8%*		*37%*	*10%*		*4%*		*9%*				
Lebanon (2006)		11		15		27	49		7		6		37		
		7%		*9%*		*17%*	*31%*		*4%*		*4%*		*23%*		
Morocco (2004)	***2***	160	***1***	**80**	***1***	**334**	72		19	*4*	61		3	*3*	
		20%		*10%*		*41%*	*9%*		*2%*		*8%*		*0%*		
Egypt (2006)	*3*	**170**	*4*	36	*4*	109	**150**	***1***	**231**	***1***	**103**	***2***	**50**	*4*	
		18%		*4%*		*12%*	*16%*		*25%*		*11%*		*5%*		
Saudi Arabia (2005)							94	***2***	**185**			***2***	**51**		
							28%		*56%*				*15%*		

Annex 8: Investment Climate and Plant Characteristics (b)

Chart 1: Composite *IC* Indicators (MENA/ non-MENA)

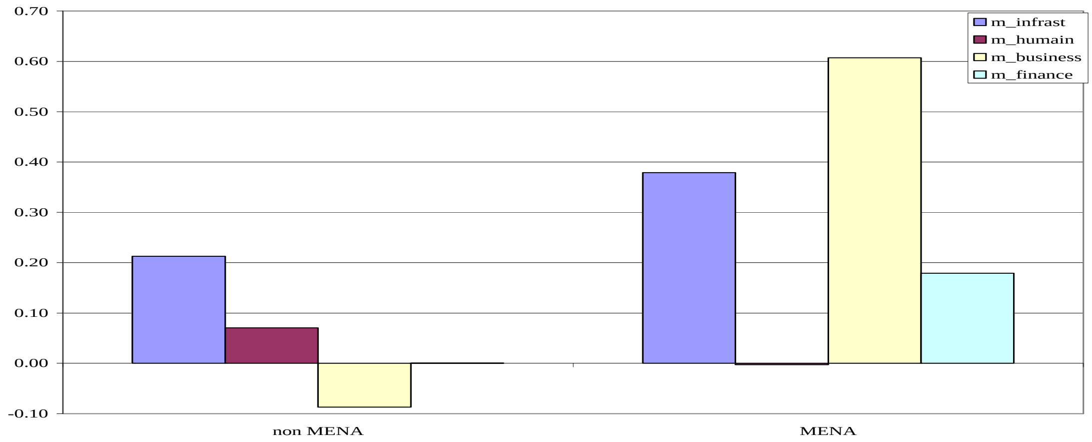


Chart 2: Composite *IC* Indicators (regions)

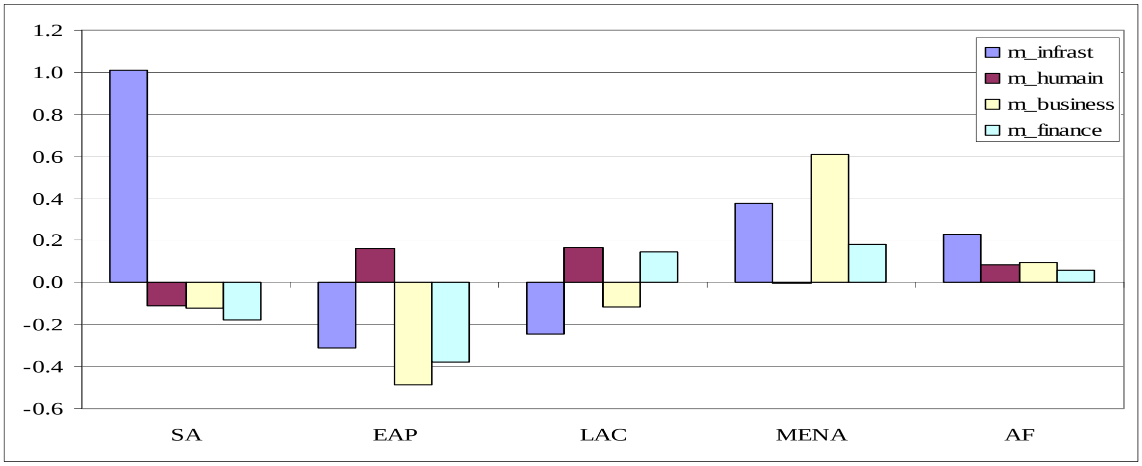


Chart 3: Composite *IC* Indicators (countries)

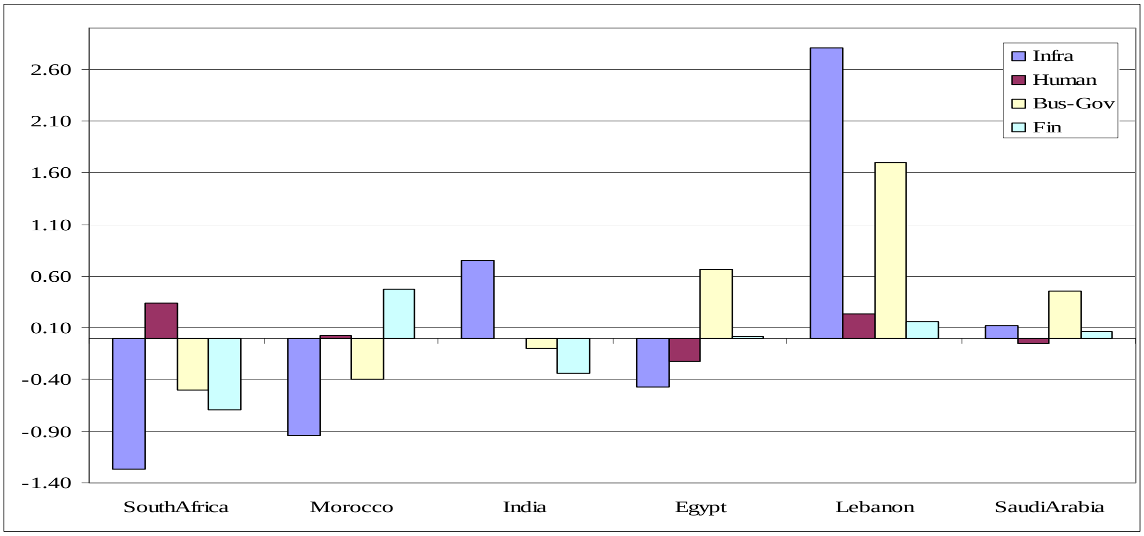


Chart 4: Infrastructures (obstales)

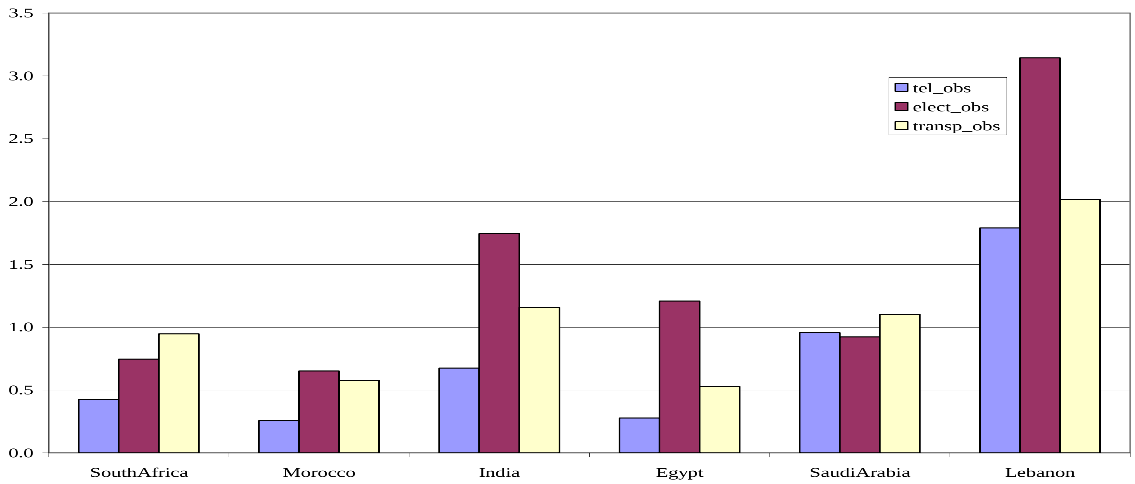


Chart 5 Infrastructures (electricity)

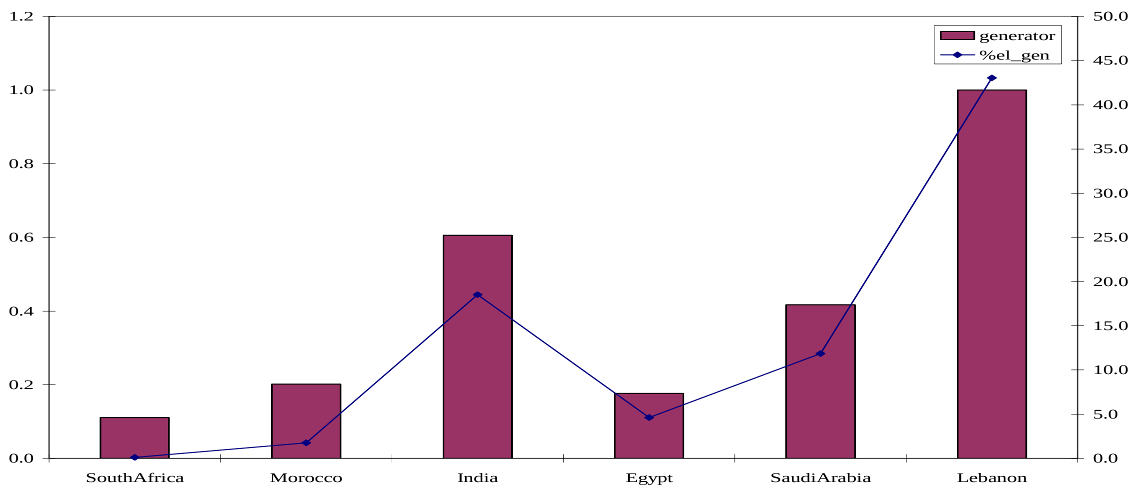


Chart 6: Infrastructures (Internet)

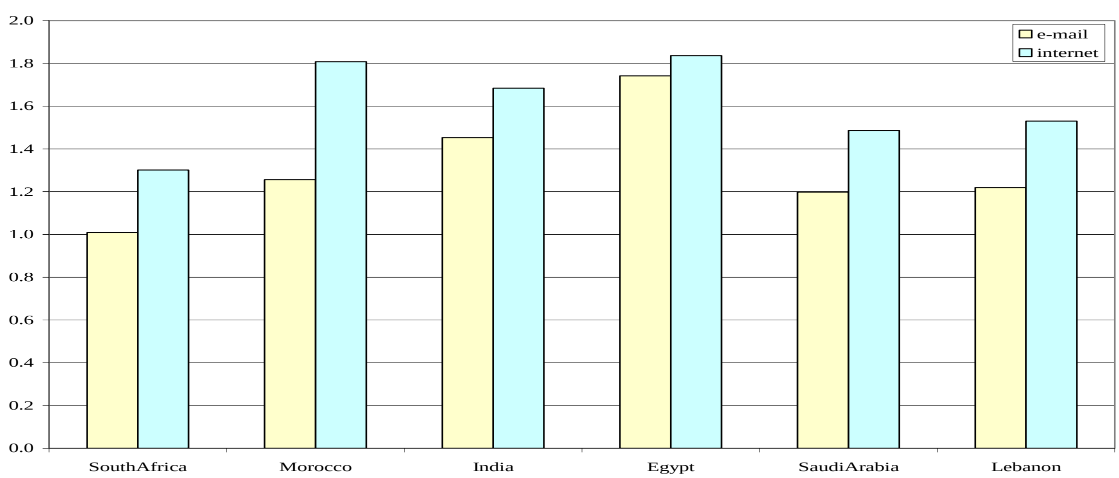


Chart 7: Human Capacity

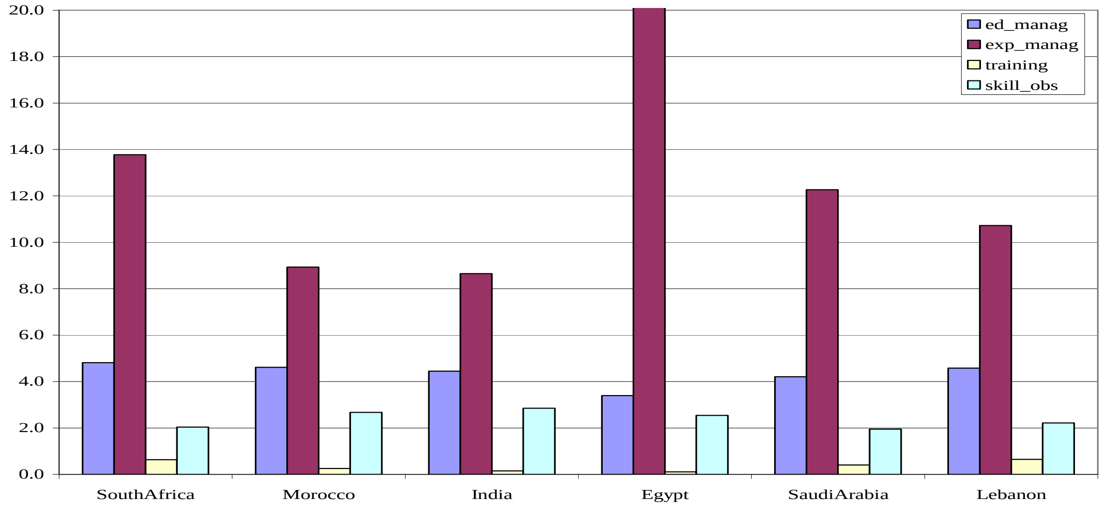


Chart 8: Government-Business Relation

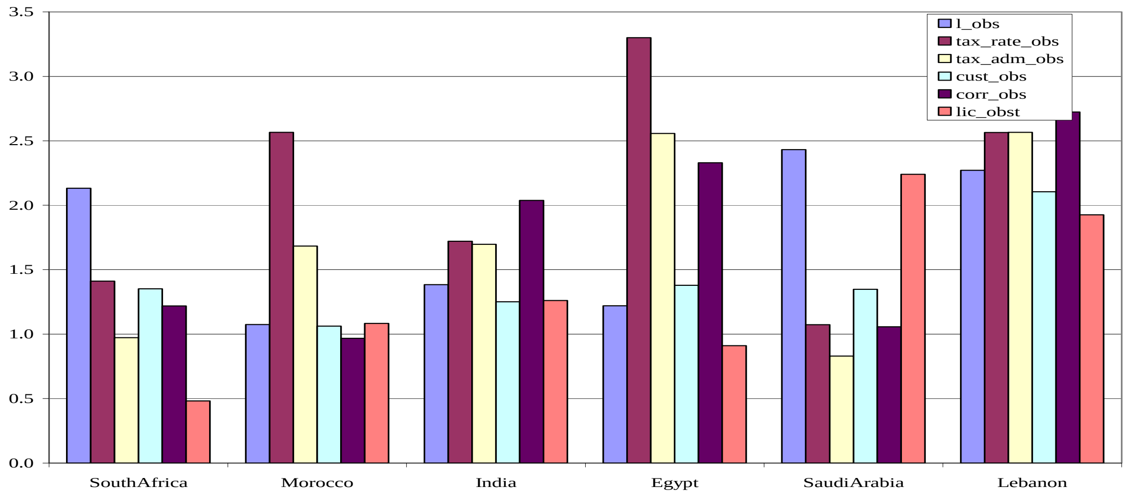


Chart 9: Financing Constraints

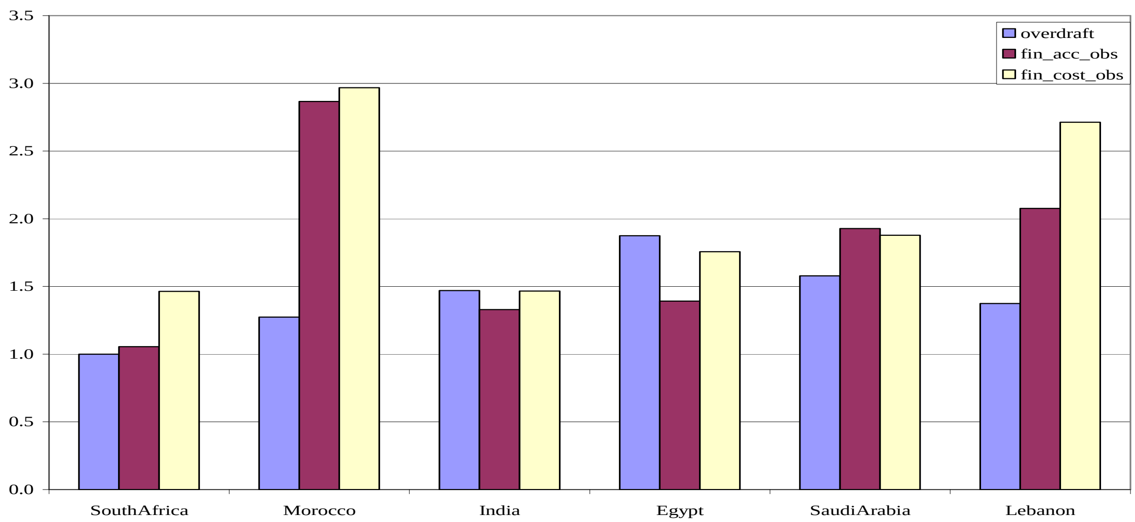
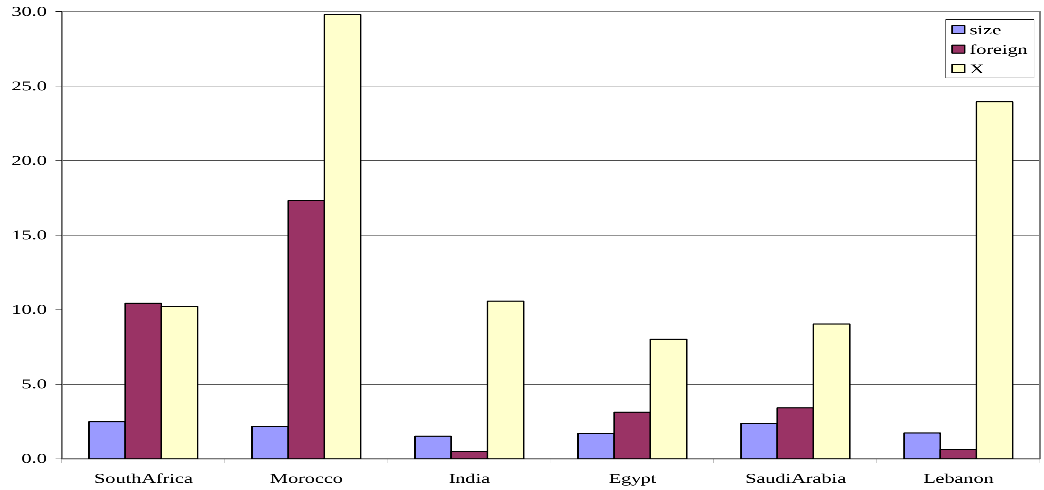


Chart 10: Firms Characteristics



Note: All variables "obstacles" are averages of dummies going from 0 (none) to 4 (severe); *generator*, *training*, *overdraft* are averages of dummies 0 or 1 (0 for *No* and 1 for *Yes*); *e-mail* and *internet* are average of dummies 1 and 2 (1 for *Yes* and 2 for *No*); *ed_manag* is an average of dummies going from 1 to 6; *%el_gen* is the percentage of electricity coming from a generator; *Infra* , *Gov_Bus*, and *Fin* can be read as obstacles; *Human* can be read as a capacity; *foreign* is the percentage of firm's capital own by foreigners; *x* is the percentage of firm's sales exported; *size* is a variable calculated from the number of permanent workers.
Source: Authors calculations

Notes

[1] See Bosworth and Collins (2003); Djankov and al. (2002); Dollar and al (2005); Hall and Jones (1999); Haltiwanger (2002); He et al. (2003); Loaya, Ociedo and Serven (2004); OECD (2001); Rodrik, Subramanian (2004); McMillan (1998 and 2004); World Bank (2003, 2004).

[2] See in particular Frankel (2002) and Rodrik (1999).

[3] See for example, Acemoglu, Johnson, and Robinson (2001); Easterly and Levine (2003); Hall and Jones (1999); Knack and Keefer (1995); Rodrik, Subramanian, and Trebbi (2002);.

[4] See Easterly and Levine (2003); Knack and Keefer (1995); North (1990); Rodrik, Subramanian and Trebbi (2002); and Saleh (2004). See Acemoglu, Johnson and Robinson (2001); Calderon and Chong (2000) in the context of growth.

[5] See Mauro (1995); Gupta, Davooli and Alonso-Terme (2002); Mo (2001); Tanzi and Davooli (1997).

[6] See Kerr (2002); Hernando and Soto (2000).

[7] See Evans and Rauch (2000).

[8] See Bastos and Nasir (2004); Dollar and al. (2005); Eifert and al. (2005); Escribano and Gasch (2005).

[9] Some important limitations can be found in the cost and access to financial services (this is the case of *Morocco*, and to a lower extend of *Egypt* and *Algeria*) in the tax system (for example in *Egypt*, but also *Algeria* and *Morocco*), as well as in the regulatory environment (for example in *Saudi Arabia*,)

[10] See see El Badawi (2002); the World Bank (2004a); Aysan et al. (2007a).

[11] See Nabli. (2007); Nabli and Véganzonès-Varoudakis (2004); Aysan, et *al*. (2007a and b).

[12] See Sekkat and Véganzonès-Varoudakis, (2007); Nabli and Véganzonès–Varoudakis (2007).

[13] Measuring productivity in level, although more restrictive than measuring growth rates (it requires for example specific functional forms of the production function) is less demanding in terms of data quality requirement. It allows, in particular, unbalanced panels with short term dimension, measurement errors, or constant value of *IC* variables (see Escribano and Guasch, 2005).

[14] See Marschak and Andrews, 1944; Griliches and Mairesse, 1995

[15] Some countries benefit from two surveys. This is the case of *Egypt* (2004, 2006), *India* (2000, 2002) and *Morocco* (2000, 2004).

[16] The year of the survey is into brackets. *Lebanon* and *Saudi Arabia*, however, are less represented than the other countries of the region. In the case of *Lebanon*, the low number of observations makes sometimes results difficult to interpret. For *Saudi Arabia*, firms' surveys cover only 3 of the 8 branches studied (*Agro-Processing*, *Wood & Furniture*, *Metal & Machinery*).

[17] Some inconsistencies have been seen, for example, when the hypotheses of constant returns to scale in *TFP* calculations led to a negative contribution of capital, or when the residual of estimation of the production frontiers was not in line with the standard deviations of the regressions and influenced too much the estimation of coefficients (we used DFFITS detection method in that case, see Maddala, 1988). For some countries, this has sometimes led to eliminate a whole sector. This has been the case when the number of enterprises left concluded to be smaller than 10 or when more than 70 per cent of the firms had been eliminated from the initial population (we accepted to make an exception for *Lebanon*).

[18] For MENA, the loss of information fluctuates from 22% in *Garment* to 41% in *Wood & Furniture* (around 30% in *Metal & Machinery Products, Non Metal & Plastic Materials* and *Textile*, and 35% in *Leather, Agro-Processing* and *Chemical & Pharmaceutical Products).* This loss is of 20% to 25% for the whole sample of countries, what is lower than for MENA. This means that answers in MENA were, in average, less satisfactory than in the other countries of the sample. As for the contribution of MENA to the whole sample, when estimating the production frontiers, it varies from 11% in *Wood & Furniture* to 37% in *Non Metal & Plastic Materials* (25% in average for the whole manufacturing industry, see Table 1-a.), what is a bit less than, but consistent with, the contribution of MENA to the initial sample.

[19] This percentage is of 45 in the whole sample, what confirms that firms in MENA did not answer the questionnaire as accurately as the rest of the sample. This is the case in all industries, but more particularly in *Agro-Processing*, *Chemicals & Pharmaceutical Products* and *Wood & Furniture*, in which almost 20% less enterprises have given correct *IC* information.

[20] Firms are asked to evaluate their constraints on a scale going from none to very severe.

[21] We ensure to get a sufficient number of observations by city and sector.

.

[22] The choice of an adequate exchange rate depends, among other things, on the exchange rate regime of the country. In presence of a floating exchange rate regime, the volatility of the current exchange rate may affect the perception of the productive performances. This is particularly true for the Labor Productivity (*LP*). For Total Factor Productivity (*TFP*), this problem is somewhat attenuated by the fact that the same exchange rate is used to convert intermediate consumptions and capital in the denominator, and production in the numerator. Using current exchange rate introduces, as well, a bias for example when fixed exchange rate policy leads to an overvaluation of the currency or when the floating rate suffers from overshooting. Current exchange rate has the advantage to represent the rate that firms deal with when making their own economic calculations. This is the rate that the producer faces when he competes on external as well as domestic markets. Both, a constant exchange rate or the use of a Purchasing Power Parity (*PPP*) exchange rate with the US dollar, are surely more problematic for our analysis. *PPP* conversion rate is useful when comparing purchase power of income per capita. We know that the purchasing power in developing countries tends to be higher than when GDP per capita is converted using nominal exchange rate. But when dealing with production, current rate is more representative of the enterprises' economic reality. The choice of exchange rate does not seem to change radically the perception of the firms' productive performances. The coefficient of correlation of our three measures of firm-level productivity using alternatively current and constant exchange rates is relatively high.

[23] Some countries benefit from two surveys, namely *Egypt* (2004 and 2006), *India* (2000 and 2002) as well as *Morocco* (2000 and 2004, see Table 1 in *Annex* 1).

[24] The variable Direct Raw Material Costs is not available from the surveys.

[25] Our analysis is based on firm-level productivity average and median. Generally, averages have been found higher than medians (30 % higher in some cases). We are in presence of an unsymmetrical distribution, where a small number of high performing firms increase the average productivity. In this context, the median is more representative of the typology of the firms. The median has also the advantage to be more stable when the size of the sample is changing. The average, however, summarizes well the productive performances of all the firms of the sample. It is these averages that have been used, when calculating the percentages in Table 2 and 3. Medians are, however, also displayed in Table 3, *Annex* 3.

[26] It can be noted that firms in *Saudi Arabia* seem to perform very well in the sectors covered by the survey (*Agro-Processing, Metal & Machinery Products,* and *Wood & Furniture*). This result will be explained in next section.

[27] Interpretation of results is, however, more difficult for some countries. This is the case of *Lebanon*, for which the number of observations is too small (5 for *Textile* and 16 for *Agro-Processing*) to reach a reliable conclusion. The combination of two surveys for *Morocco* and *Egypt* allows more than one hundred observations by branch. *Morocco,* for example, benefits from 500 enterprises in *Garments*. In *Saudi Arabia*, firms present quite good productive performances, although most of the branches suffer also from a relative small number of observations. In *Wood & Furniture*, firm-level *TFP* is one of the highest of the sample. This result confirms the conclusion reached for Productivity of Labor.).

[28] See Manly (1994); Mardia, Ken and Bibby, (1997); Nagaraj and *al*. (2000); Mitra and *al*. (2002); Nabli and Véganzonès-Varoudakis (2007); Aysan and *al*. (2007a and b).

[29] Obstacles' value goes from *none* (0) to *very severe* (3).

[30] See Aschauer (1989), Argimon et al., (1997), Barro (1990), Blejer and Kahn (1984), Murphy, Shleifer, and Vishny (1989).

[31] For spatial externalities, see Holtz-Eakin and Schwartz (1995).

[32] Education level goes from primary to post graduate

[33] See Lucas (1988), Psacharopoulos (1988), and Mankiw, Romer and Weil (1992).

[34] The principal components of the initial variables were extracted for each aggregated indicators. The four composite indicators were then constructed as the weighted sum of two or three principal components, depending of the explanatory power of each component. We chose the most significant principal components whose eighenvalues were higher than one. In this case, we explain around 70 percent of the variance of the underlying individual indicators. The weight attributed to each principal component corresponds to its relative contribution to the variance of the initial indicators (calculated from the cumulative R^2). The contribution of each individual indicator to the composite indicator can then be computed as a linear combination of the weights associated with the two or three principal components and of the loadings of the individual indicators on each principal component. For more details on the aggregation method using Principal Component Analysis (*PCA*) see Nagaraj, Varoudakis, Véganzonès (2000), and Mitra, Varoudakis, Véganzonès (2002).

[35] See in particular the World Bank Investment Climate Assessments (*ICA*) of *Egypt* (2005 and 2006), *Morocco* (2001 and 2005), and *Algeria* (2002). Doing Business 2005-2009 ranks as well MENA particularly low in reforms regarding the labor market, getting credit, enforcing contracts, construction permits, starting a business, closing a business and protection of investors (see the World Bank, 2009). Nabli (2007) also stresses MENA above average licenses, domestic taxation, import duties, regulatory and administrative barriers to firms start up and operations, opaque bidding procedures and official acceptance of uncompetitive practices, unpredictable judicial systems that do not facilitate the restructuring of viable business or the closure of nonviable ones, as well as weaknesses in infrastructure and financial system. With public bank dominating the banking system in many countries and favoring state enterprises, large industrial firms and offshore enterprises, small and medium firms in particular find it difficult to get the startup and operating capital they need.

[36] We will also stress a contraction in the answers to the survey which justifies taking into consideration quantitative indicators, to complete the information given by qualitative ones. In the case of electricity, although more firms than in other regions seem to rely on a generator, comparatively less declare electricity as a strong constraint for operating.

[37] We will recall that the Value Added is calculated as the difference between "Total Sales" and "Total Purchase of Raw Material -- excluding fuel".

[38] The new literature on international trade associates firms' size with increasing returns to scale, market imperfections and product heterogeneity linked to technological innovation. The literature on corporate governance, as well, describes the difficulties in inciting and controlling big enterprises, although they are more able to reduce transaction costs and facilitate economic calculations. Small enterprises are described as less capitalistic and more flexible in a volatile environment, in particular in economies characterized by rigidities which encourage the development of the informal economy.

[39] For two sectors: *Chemicals & Pharmaceutical Products*; and *Wood & Furniture*, coefficients of capital and labor are slightly smaller than in previous estimation (see Table 5).

[40] For Infrastructure, the quality of the electrical network (*RegElect*) appears to increase firms' performances in *Garment* and *Metal & Machinery Products*. It is, however, the access to internet (*RegWeb*) which emerges as a factor of productivity in more industries (*Textile*, *Agro-Processing*, *Chemical & Pharmaceutical Products* and *Wood & Furniture)*. As far as Human Capacity is concerned, level of education of top manager (*EduM*) is significant in almost all sectors (except *Leather* and *Wood & Furniture)*, meanwhile number of years of expertise of manager (*ExpM*) and training of employees (*Training*) seem to play a role in only one sector each (*Textile* and *Agro-Processing* respectively). Same conclusions can be drawn for Financing Constraints, where access to credit line or overdraft facility (*Cred*) appear to generally stimulate productivity gains (except in *Chemical & Pharmaceutical Products* and *Wood & Furniture*), though the qualitative variable of access to financing (*AccessF*) is significant in only three sectors (*Agro-Processing, Chemical & Pharmaceutical Products,* and *Wood & Furniture*).

[41] In these industries, a few factors seem to explain efficiency (only access to credit line (*Cred*) in the case of *Leather* and, internet access (*RegWeb*) and access to financing (*AccessF*) in the case of *Wood & Furniture*). On the opposite, *Agro-Processing, Chemical & Pharmaceutical Products, Garment,* and *Textile* display a broader set of factors explaining firms' productivity gains.

[42] : respectively seven and six instead of two for Infrastructures and Business-Government Relations, four instead of three for Human Capacity, three instead of two for Financing Constraints.

[43] Loss of information appears essentially for "Human Capacity" and "Infrastructure" for which one of the initial individual indicators was previously significant.

[44] Besides, this model explains better *Wood & Furniture.*

[45] Based on the number of observation of the regressions, big foreign enterprises constitute 30% of the sample in *Leather*, 24% in *Agro-Processing*, 23% in *Metal & Machinery Products*, 21% in *Textile*, 18% in *Chemicals & Pharmaceutical Products*, 17% in *Garment*, 14% in *Non Metal & Plastic Materials* and 13% in *Wood & Furniture*.

[46] The overall explanatory power of the model is not very different for both samples. In *Textile*, *Garment* and *Agro-Processing*, firms' Technical Efficiency (*TE*) gap seems to be explained by more *IC* variables or plant characteristics for relatively small domestic enterprises, confirming that these industries are more sensitive to deficiencies in the investment climate. Opposite result is slightly observed in *Wood & Furniture* and *Chemicals & Pharmaceutical Products*. As for *Leather* and *Metal & Machinery Products*, these sectors are still poorly explained in both samples.